SCIENTIFIC AMERICAN

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A NEW SUBMARINE BOAT.

The submarine boat Goubet (so called from its inventor), the adventures of which are already celebrated, has just entered upon a new phase. It has, in fact, left the Napoleon basin, where it has been stored for fifteen months in an unoccupied corner of the Cherbourg Military Arsenal, in order to proceed to definite experiments—a trial in diving in the Commerce basin.

It was six weeks ago that these curious experiments took place before the eyes of hundreds and thousands of witnesses, and, if we are to believe the accounts that our correspondents have transmitted to us, they were all wonderfully successful.

Thus, on the 31st of January, the Goubet started all alone, without guide or tow boat, from the maritime arsenal, and, after a few evolutions in the roadstead, that lasted less than an hour and a half, entered the Commerce basin without hesitation, and without turn or zigzag, in spite of the difficulties and obstacles without number in this place in the way of buoys, dead bodies, ships at anchor, and intererossed mooring chains. This little promenade took place *on the surface* without doubt, but it was none the less a peremptory demonstration of the manageableness of the Goubet, and its capability of steering straight. There was no lack of persons, in fact, to believe and say that if the Goubet resembled a fish it was a "drunken" one, and that it would never be capable of traversing a channel ever so narrow and variable without bumping against the walls.

To the honor of the new torpedo boat, it is well to add that the currents are at times very strong at the entrance of the port of Cherbourg, and that upon this day the sea was very rough.

Two days afterward the Goubet proceeded to new experiments. Without any fastenings, and consequently given up to its own forces and resources, the strange boat sank several times to different depths, with its two navigators hermetically immersed within its sides of bronze. It remained stationary for four hours successively at one meter and three and a half meters, thus proving its perfect stability, its habitability, and its curious faculty, apparently contrary to all physical laws, of remaining immovable beneath the water as long as it pleases and at a definite depth.

During this immersion, the navigators passed away their time in playing numerous games of piquet and in breakfasting. Owing, in fact, to a supply of oxygenated gas strongly compressed in tight tubes, and which an ingenious arrangement automatically distributes at the ordinary atmospheric pressure, while a pump expels the gaseous residue, it is as easy to breathe in the boat as it is in the open air.

We know that at the time of the first official experiment, the two navigators of the Goubet remained eight full hours under water without any other communication with the outside world than the telephone wire that they used to give their impressions, which, by the way, were of a cheerful character. When they made their appearance, they were fresh, well, and lively, having been able to attend to all the functions of life, and being ready to begin again. There was still in the tubes enough oxygen to last twenty hours.

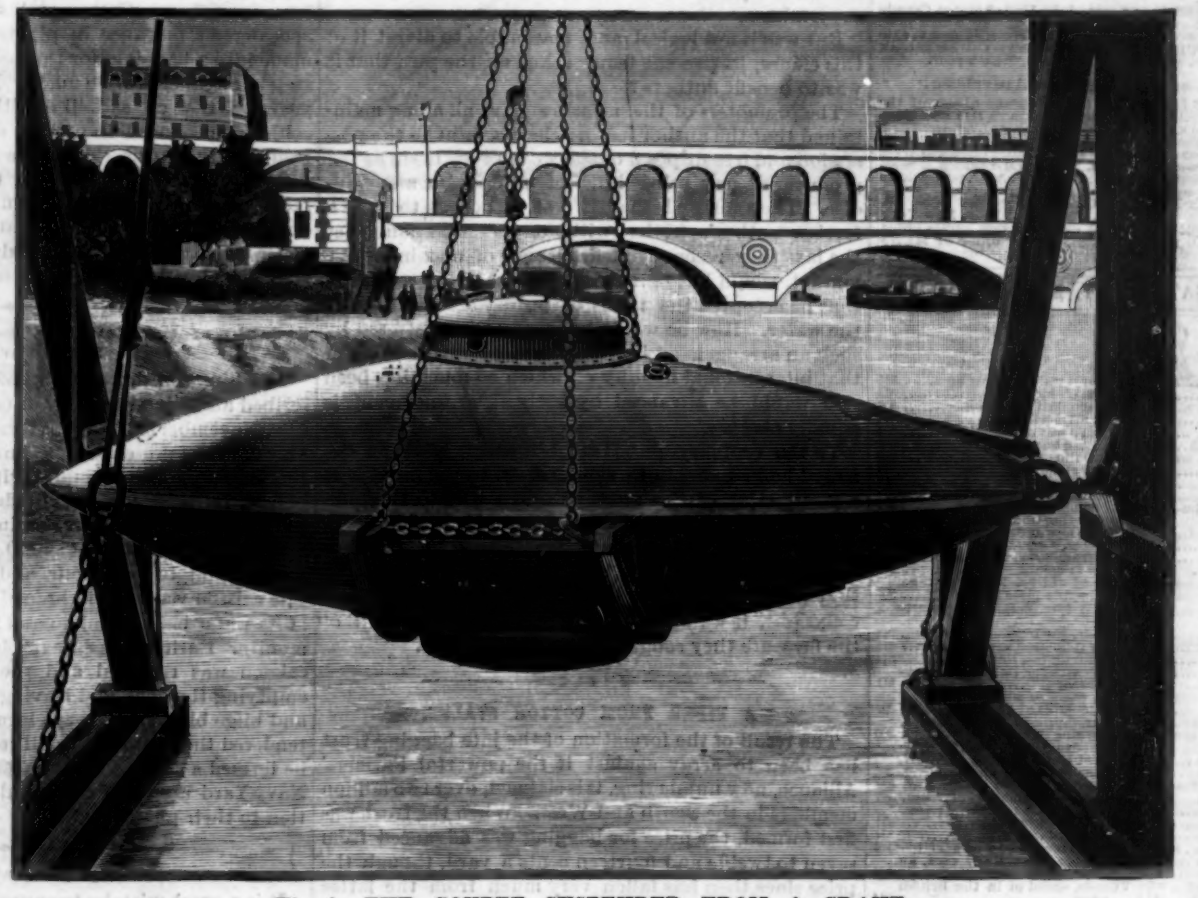

Fig. 1.—THE GOUBET SUSPENDED FROM A CRANE.

Fig. 2.—EXPERIMENT IN STABILITY.

It has been said of the Goubet that it is a realization of the dream conceived by Jules Verne in his "Twenty Thousand Leagues under the Sea;" but the Goubet is better than that. It is not only one romance, but it is rather two of the great amuser's romances amalgamated. It is both "Twenty Thousand Leagues under the Sea" and "Doctor Ox" in action!

It is well to note, by the way, that the Goubet is not only the sole submarine boat that has remained for eight hours under water with men inside, but also the sole one from which a like power has been required. The conditions imposed upon the inventor by the contract were, in fact, exceptionally hard. But, in the serenity of his assurance, and with that superb faith that mocks at the worst difficulties, Mr. Goubet accepted all.

Figs. 3 and 4 represent two of the phases of the dramatic eight hour experiment. In Fig. 3 the Goubet is preparing to disappear, in Fig. 4 it has come to a rest at a depth of one meter, to remain there for twenty minutes. How the Goubet realizes this paradox it is impossible to say. That is a secret between the inventor and the government.

As may be seen from Fig. 1, where it is represented suspended by the chains of a crane, the Goubet has the form of a stubby cigar, or rather of an elongated egg. It was cast in bronze in a single piece. It is 5·6 meters (18 ft.) in length, and 1·53 meters (5 ft.)

(*Continued on p. 310.*)

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THE COPYRIGHT BILL FAILS TO PASS.

The defeat of the copyright bill in the House of Representatives by a vote of 126 to 98 disproves the assertion so often made in certain quarters that the sentiment of the public is growing more and more favorably disposed to the measure, for, remembering that the vote on the measure last session was almost a tie, it would seem that longer consideration of its merits has increased rather than lessened the opposition to its passage. Nor will the fate of this bill appear undeserved, when its characteristics and intent are critically examined. It purported to be an "authors'" bill. In their name it was drawn up, in their name Congress was asked to make it a law.

On examination it proved, instead of an authors', to be a publishers' bill, and to be strongly opposed to the interest of the general public, giving the publishers the right to increase the cost of foreign books—a virtual monopoly or patent for 42 years; indeed, the foreign author being left to accept whatever terms were offered him or be debarred from publishing on this side the ocean at all.

The promotors of the bill seem agreed that its defeat was due to the action of Mr. Payson, of Illinois, by which was struck out the provision that foreign books should be printed in the United States to obtain a copyright.

But was it not logical and reasonable to divest it of this clause, its passage being asked on the plea that it was to benefit authors?

The promoters of the measure have all along maintained that the author has as clear a right to the possession and free disposal of the work of his brain as the producer of any other kind of marketable merchandise. They insisted that it was dishonest to take a foreign author's works without compensation. Yet the law they recommended, instead of opening a free market, would have given him leave only on condition that he accepted the terms of publishers on this side the water. How he would be in any wise bettered by such an arrangement it is hard to see; how the cause of that international honesty of which so much has been said would be advanced by such an arrangement, is equally obscure.

To the ordinary mind the bill which has been defeated looked simply to self-interest, to the interest of a small class of the community, to wit, to the publishers, as against the many. It would, in fact, have tended to raise the price and consequently restrict the sale of the reprint, that boon to hungry readers. If that was not the aim of the promoters of international copyright, it would assuredly have been the result of the measure they sought to have made a law.

A FIBER FROM COTTON STALKS.

The result of the formation of the jute bagging trust has been to array against it the powerful Farmers' Alliance, now numbering, it is claimed, over two million members in the South and West. When the trust was first formed, the price for bagging was advanced from seven to twelve and fourteen cents a yard, though the price since then has fallen very much from the latter figures. The Southern planters requiring bagging for their cotton made up their minds on no account to make any purchases from the jute bagging trust, and some of them, in order to keep this vow, have used other bagging which entailed a net loss of a dollar on every bale sent to market. The high price of jute bagging, as well as the bitter war between the planters and the trust, have greatly stimulated the production of substitutes. Pine needles, bear grass, palmetto, and Spanish bayonet fibers have all been employed, but the product has been far from satisfactory. The bagging made from pine needles has been more extensively used, perhaps, than any other, but it is apt to stain the cotton, and it tears easily. Cotton sheeting is used, but this also is not strong enough, and the insurance companies object to it as not offering sufficient protection to the cotton in case of fire. As a further indication of the desperate shifts to which planters have resorted rather than use jute bagging, it may be said that cotton has been received in New York baled with willow sticks and iron hoops, so that it was necessary to open the bales with an ax.

Reliable advices from Augusta, Ga., recently received seem to indicate that the want of a satisfactory substitue for jute bagging has been met by producing a fiber from cotton stalks. Mr. William E. Jackson, a lawyer of Augusta, has given a good deal of time and attention to developing the process. He commenced experimenting with a machine patented to produce certain South American fibers by running cotton stalks through it and then submitted the fiber to a carding machine, and the result was an article which closely resembles what is known as jute butt yanks. Mr. Jackson then sent a bale of this material to a bagging factory at Paterson, N. J., and proceeded thither himself, and the bagging which was produced under his direction has been declared to be an excellent article.

A detailed description of the process by which the fiber has been obtained cannot be given at this time, but it is known that the bark is removed from the stalks by means of a breaker. It is said, however, that the bark can also be stripped off by hand, or the stalks may go through the machine in their natural state, and the rollers will do the work just as thoroughly. The main feature of the fiber-producing machine consists in the forward and backward movement of the rollers, which action separates the fiber while the water underneath washes out the glue. The advocates of the new process claim that they can pay $2 a ton for cotton stalks delivered at railroad stations, and make from them a bagging which can be sold at 7½ cents a yard, a price at which they claim jute bagging cannot be manufactured at a profit. The article produced from cotton fiber weighs about two and a quarter pounds to the yard, and the average requirement for a bale is seven yards.

A cotton exporter recently stated that the bagging made from cotton stalks which he had examined resembled jute so closely that even a person who was accustomed to handling cotton would not readily detect the difference. It will not stain the cotton, and will show marks easily. It is said that the annual yield of stalks will produce bagging sufficient to bale three yearly crops of cotton.

Should the new fiber stand the test of general use, it is easy to see that a new and extensive industry has been opened up. Cotton stalks have heretofore been considered a nuisance by planters, but if they can be made into a bagging for the baling of cotton, a great step in advance will be made. No one dreamed a few years ago that oil as well as other valuable products could be produced in paying quantities from cotton seed, but this utilization of the seed forms one of the most striking as well as one of the most important of recent advances in manufacturing. The public will doubtless watch with much interest, to see if still another new and important product is to be developed from the already fruitful cotton plant.

Opening of the New Dry Dock at the Brooklyn Navy Yard.

The Simpson dry dock, which has already been described and illustrated by us (see SCIENTIFIC AMERICAN, November 30, 1889) was formally opened on Friday, May 9, in the presence of a number of spectators, including many visitors and invited guests from Washington, Baltimore, and Philadelphia, as well as representative naval officers, engineers, and others of the vicinity. Promptly at 10:30 A. M. the dock was flooded, and in one hour and five minutes was full. The caisson was then lightened by the ejection of some of its water ballast and floated to one side. The U. S. monitor Puritan was next placed in the dock, the caisson was replaced and the large pumps started, emptying the dock and leaving the ship upon the keel and bilge blocks. A very elegant collation was then tendered the visitors. In all respects the occasion may be termed a success, and the officials of the Brooklyn Navy Yard are to be congratulated on this last addition to their plant.

Keeping at It.

It is a great mistake to suppose that the best work of the world is done by people of great strength and great opportunities. It is unquestionably an advantage to have both these things, but neither of them, quoting from the *Manufacturer and Builder*, is a necessity to the man who has the spirit and the pluck to achieve great results. Some of the greatest work of our time has been done by men of physical feebleness. No man has left a more distinct impression of himself on this generation than Charles Darwin, and there have been few men who have had to struggle against such prostrating ill health. Darwin was rarely able to work long at a time. He accomplished his great work by having a single aim, and putting every ounce of his force and every hour of his time into the task which he had set before him. He never scattered his energy, he never wasted an hour, and by steadily keeping at it, in spite of continual ill health and of long intervals of semi-invalidism, he did a great work, and has left the impression upon the world of a man of extraordinary energy and working capacity. Success is rarely a matter of accident; always a matter of character. The reason why so many men fail is that so few men are willing to pay the price of self-denial and hard work which success exacts.

Burning of the Great Singer Sewing Machine Works.

The great works of the Singer Sewing Machine Co., at Elizabethport, N. J., were seriously damaged by fire on the 6th of May. The main building, with its valuable contents, including millions of needles, several thousand finished sewing machines, and an immense stock of partly finished machines, tools, etc., were destroyed. The loss is estimated at $750,000. Rebuilding will be at once commenced, and temporary structures erected for the immediate resumption of regular work. The entire area occupied by the company is 32 acres. The main building was 230 feet long, 60 feet wide, with annex 800 feet long, 50 feet wide, 4 stories high.

Microscopical Reception.

The annual reception of the Department of Microscopy of the Brooklyn Institute took place on the 8th inst. The occasion was one of considerable interest. There were 72 exhibits shown under as many microscopes. The number of guests present exceeded 1,000; the array of instruments was very fine indeed, and the interest manifested in the exhibits was very gratifying to the members of the department.

The following list of exhibits is so long as to preclude the possibility of giving a description of each one.

Volcanic dust from Java eruption. Fell on the bark Arabella, August 28, 1883, 1,000 miles from Java. Lat. 5° 37' S.; long. 88° 58' E. Ringworm of scalp, prepared to show its effect on the hair. Foot of silkworm. *Callimome regius*, a parasitic fly, exhibited by Mr. Henry Fincke. Peptic glands from the cardiac region of the stomach of the frog, Dr. Heber N. Hoople. Skin of eel, scales *in situ*, shown by polarized light, by Mr. William Finney. Micro-photograph, Declaration of Independence, Prof. W. Le Conte Stevens.

Section of pallasite (meteorite), from Kiowa County, Kansas, shown by Mr. George F. Kunz. The Kiowa County meteorites numbered twelve in all, of which six were pallasites (a spongy iron filled with olivine).

Pollen of the century plant, from a plant in the conservatory of the late Wm. Darlington, Pittsburg, Pa. Age at bloom fifty-one years. Was shown by Mr. W. G. Bowdoin. One hundred and twelve different varieties and species of diatoms arranged on one slide were shown by Mr. G. D. Hiscox.

Dr. Herbert Fearn exhibited a section of human kidney. Double injected. Arteries and malphigian tufts injected red, and veins injected blue. In the lighter portions were seen the uriniferous tubules. A section of melaphyre from Bas Matachin, Isthmus of Panama, was shown by Mr. Thomas B. Briggs. This is one of the very hard rocks encountered in the excavation of the proposed Panama canal. Melaphyre was described as a fine-grained brownish-black aggregate of plagioclase, augite, olivine, magnetite, and delessite or chlorophocite. Mr. James Walker exhibited a section of prehnite, from the glacial drift of Brooklyn. A vertical section of human scalp, showing hairs, etc., *in situ*, was shown by Dr. C. K. Beldin. The exhibits of Mr. George E. Ashby consisted of a transverse section of leaf (pine needle) of Scotch fir and spiracles (breathing pores) and tracheæ (air tubes) of silkworm. The aeration of the blood in insects is provided for by the introduction of air into every part of the body through a system of minutely distributed air tubes.

Transverse section of peduncle of yellow water lily was shown by Mr. Joseph Ketchum. Rutile crystals in quartz, from North Carolina, and artificial crystals of cadmium, constituted the exhibit of Mr. George M. Mather. Mr. Frank Healy presented polycystina from Springfield, Barbados, and butterfly scales arranged to form a bouquet of flowers. Quartz crystals, from Herkimer Co., New York, were shown by Mr. Charles Ronfeldt. Pond life formed the exhibits of Mr. Stephen Helm and Mr. C. H. Taylor. Spore cases of fern from New Zealand were shown by Walter H. Kent, Ph.D. Transverse section of petiole (leaf stalk) of carrot, by Mr. William W. Laing. Pollen of moon flower, by Mr. William Lowey. Mr. Edward C. Chapman exhibited a transverse section of stem of beech. A beautiful cluster of gold artificial prisms, and aurified cloth were shown by Dr. A. J. Watts. The cotton fiber of the latter specimen has been replaced by gold, a substitution similar to that which has taken place in petrified wood.

Crystals of proustite, "ruby silver," from Chili, S. A., were shown by Dr. Joseph H. Hunt. This silver ore contains 65 per cent of the metal. The illumination was effected by means of a paraboloid condenser. Ancient iridescent glass from Cyprus was shown by reflected and polarized light, by Mr. Geo. M. Hopkins. Foraminifera, the skeleton remains of a low order of animal life, chiefly marine, formed the exhibit of Mr. William Potts. Section of granite, by polarized light, and cyclosis (circulation) of protoplasm in cell of chara, one of the fresh water algæ, were shown by Prof. Franklin W. Hooper. A transverse section through head of larva of newt, showing cerebrum, eyes with lens and retina, tongue and lower jaws, cartilaginous bones and blood vessels, was exhibited by Mr. Ludwig Riederer.

Rev. J. L. Zabriskie's exhibit consisted of: Teeth of mosquito, showing eleven teeth at the extremity and upon the thin edge of each flattened, bristle-like mandible; the ovipositor of the narrow-winged katydid, polarized, showing two saws, two sheaths, and two stylets. A section of meteoric stone from Segowlee, India, which fell March, 1853, shown by polarized light; and meteoric iron from Toluca, Mexico, etched to show the Widmanstattian and Neuman lines, formed the exhibit of Mr. Albert A. Hopkins.

Stinging hairs of nettle were shown by Prof. W. C. Peckham. The tip of the sting is broken off on entering the skin, and the poison from the gland below is pressed through the tube of the sting into the flesh. Scales of thirty varieties of South American lepidoptera, opaque; shown by automatic revolving stage; by Mr. J. D. Mallonee. Iron sand from Shelter Island; opaque; Mr. George A. Street. A section of opal from Honduras was shown by H. Hensoldt, Ph.D. The beautiful diplay of colors for which these gems are noted was here exhibited in a section of the thinness of tissue paper. Foot of the emerald spider, by the same exhibitor. In the latter object the two combs used by the spider in arranging the lines of his web are seen in rare perfection. Mr. Henry S. Gibson showed the eggs of bot fly. A transverse section of ovary of Rhododendron pontium was shown by Dr. Hugh M. Smith. Torbernite crystals, a cupreous phosphate of uranium, from Cornwall, England, was exhibited by Mr. J. W. Freckelton. Dr. S. E. Stiles showed a transverse section of spines of echinus. The saws of saw-fly formed the exhibit of Mr. H. S. Woodman. These appendages are used by the insect to saw a fine slit in a leaf, in which the eggs are deposited.

Dr. J. M. Van Cott, Jr., exhibited a large number of sections illustrating human tissue. Elytron (wing cover) of jewel snout beetle, from Brazil, S. A., by Mr. Artis H. Ehrman. Sulphide of nickel, from Chili, S. A., by Mr. F. L. Lathrop. Crystals of oxalate of lime. Shown by polarized light. The blood of snake, double stained, showing the corpuscles and their nuclei, by Frederick J. Wuling, Ph.G., and the seed of gentian, by Mr. John H. Royael, complete the list of very interesting objects shown on this occasion.

The officers of the department, under whose administration the preparations were made for the reception, were Rev. J. L. Zabriskie, president; Mr. Geo. M. Mather, vice-president; Mr. George E. Ashby, secretary; Mr. Edward C. Chapman, treasurer; Mr. J. D. Mallonee, curator.

The newly elected officers are: Mr. H. S. Woodman, president; Dr. S. E. Stiles, vice-president; the other officers having been re-elected.

Progress of the Chicago World's Fair.

The officers' salaries have been fixed. The president is to receive $6,000 annually; vice-president, $12,000; treasurer, $5,000; and auditor, $5,000. Vice-President Bryan receives a larger salary because it is expected that he will relieve President Gage of most of the work. Second Vice-President Potter Palmer declined any compensation. The Hon. A. F. Zeberger, ex-collector of customs, has been made treasurer, and W. K. Ackerman, formerly President of the Illinois Central Railroad, auditor.

The members of the ten standing committees met and elected the following chairmen: Finance, Ferd W. Peck; grounds and buildings, De Witt C. Cregier; legislation, Edwin Walker; foreign exhibits, W. T. Baker; catalogues and printing, Rollin A. Keys; transportation, Stuyvesant Fish; fine arts, C. L. Hutchinson; machinery and electric appliances, De Witt C. Cregier; ways and means, Otto Young.

The president, first and second vice-presidents, and chairmen of the standing committees constitute the executive committee.

A meeting of stockholders has been called to vote an assessment of 18 per cent on the stock, payable the first Monday in June, 1890, and on the proposition to change the name of the fair to "The World's Columbian Exposition."

Letter Postage Principle for Railroad Fares.

At a recent meeting of the American Academy of Political and Social Science, held in Philadelphia, Prof. E. J. James, of the University of Pennsylvania, said:

For the last nine months a most interesting experiment in railroad management has been going on in Hungary. As a result, a new system of passenger tariffs was worked out and put into operation on the first of August, 1889. The method adopted was that commonly known as the zone-tariff system, in which the rates are fixed, not according to the number of miles traveled by the passenger, but according to the number of zones traversed or entered upon during the journey. Starting from a given center, the railroads are divided into fourteen zones or stretches. The first zone includes all stations within 25 kilometers of the center; the second, all more than 25 and less than 40, etc.; each zone after the first up to the twelfth being 15 kilometers long, or, as we should perhaps better say, wide. Tickets are sold by zones, being good for all stations within the zone.

How radical a change this system implies for a large part of the traffic can be seen in the extreme cases, *i. e.*, in those in which the reduction has been the greatest. The fare for all stations in the fourteenth zone, which includes all stations more than 225 kilometers from the capital, are 8, 5·80, and 4 gulden respectively for the three classes, corresponding to $2.88, $2.08, and $1.44. If we had the same rate in this country, it would be possible to buy a railroad ticket to Chicago from New York for $2.92. The fare to Philadelphia would be 29 cents.

The simplification of the tariff is very great. Under the old system, the number of distinct tickets which had to be kept in every large office was nearly 700. It is now only 92.

The railroad tickets are now placed on sale like postage stamps at the post offices, hotels, cigar shops, and other convenient places. The public is greatly pleased at the discarding of the complicated machinery of ticket selling as practiced under the old system.

The most interesting thing, however, in this experiment is the way in which the passenger traffic has increased under the stimulus of the new rates. The number of passengers during the last five months of 1887 was 2,389,400; during the same period of 1888 it was 2,381,200; while for the same period of 1889—the first period under the new system—it was 5,584,000, an increase of over 133 per cent. The receipts from the traffic under the new system were over 18 per cent greater than under the old. In other words, passenger traffic will respond to lower rates, a thing which some railroad managers have denied.

It would be well for our own railroad managers who complain that passenger traffic is not profitable to look into the matter. The American people, reputed to be the most restless in the world, do not have nearly as many passengers per head of the population as England, and it is far exceeded in the number of passengers to miles of railway by half a dozen countries of Europe.

Shell Mounds of Florida.

Colonel Joseph Wilcox, one of the managers of the Archæological Museum of the University of Pennsylvania, recently gave a short account of his explorations in the Florida shell heaps. He said he had never traveled in any part of the United States that presented so many remains of the former race as Florida. The mounds were of two classes. Along the coast and the banks of the rivers they were composed of shells, while those away from the rivers and the sea are made of sand. These mounds are of prodigious size, some of the largest being twenty to thirty acres in extent, and twenty to forty feet in height. The shell mounds are composed almost exclusively of oyster shells, a large conch, which was evidently eaten, being the next most plentiful. Many of the latter have a hole broken in the top, through which it is probable the animal was drawn. The shells in one of the mounds he examined varied from those of the present day, partaking of the character of those of the Pliocene fossils, and indicate that the mound was made a very long time ago. He exhibited a collection of objects from Florida, including two gold beads, and a superb fragment of pottery that was thought to be of Georgia manufacture. In commenting upon this piece, which he presented to the museum, he said that the Greek fret, the scroll work, and many forms of classical decoration are to be discovered on the American pottery, and if we want to study the beginning of classic art, we should study the aboriginal art of America, an art that was nipped in the bud by the terrible Spanish invasion.

The museum, although only organized last year, is so well cared for by its friends that its collection is now second to none in the country.

Ether.

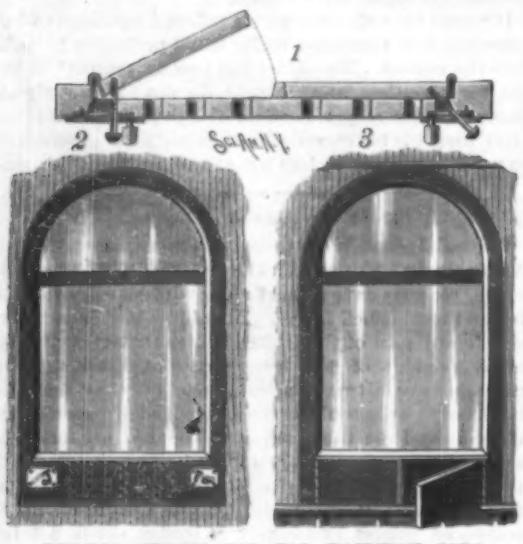
The so-called pure commercial article always contains various impurities which, on spontaneous evaporation, remain behind as an ill-smelling residue. Sulphur is detected by shaking up the sample in question in a test tube with a drop of pure bright mercury. If the quantity of sulphur is very small the surface of the mercury is merely rendered dull and gray. If there is much sulphur, the entire liquid turns gray or black. Pure chloroform does not reduce alkaline permanganate unless a trace of alcohol is present. Bertram Blount (*Analyst*) describes a series of impurities in so-called pure reagents. P. Lohman (*Pharm. Zeitung* and *Chemiker Zeitung*) discusses the purity of commercial reagents required in chemico-legal investigations. Zinc and sulphuric acid can easily be obtained free from arsenic. Hydrochloric acid which fulfills the requirements of the *Pharmacopœia* may contain traces of arsenic. Hydrochloric acid freed from arsenic by means of tin is usually stanniferous. Chloric acid may contain arsenic, and usually contains baryta.

Achievements of Surgery.

At the Surgical Congress at Berlin, Professor Gluck, of Berlin, gave (says Dalziel) an exhibition showing a most valuable advance in surgery, namely, the successful substitution of catgut, ivory, and bone freed from chalk, for defects in bones, muscles, and nerve sinews. The juices of the body are sucked up in the inserted material, thereby establishing the junction of the separated ends, without any shortening of the part. He presented the cases of patients in whom there had been an insertion of from six to ten centimeters of catgut to supply defects in the leaders of the hands, to which complete mobility had been restored. This case has previously been impossible. In the case of another patient Professor Gluck removed a tumor from the thigh, causing a considerable defect in the bone. He inserted ivory, and no shortening ensued. In another case he removed a large piece of nerve in the groin and inserted catgut, and the functions remained completely satisfactory.

AN IMPROVED VENTILATOR FOR RAILWAY CARS.

The illustration shows a device for attachment to car windows, whereby air may be allowed to enter from either side without creating a draught, and dust and cinders will be effectually excluded. It has been patented by Mr. Robert E. Burke, of Phillipsburg, N. J. Fig. 2 is an inside view of the device applied to the lower rail of the window frame, Fig. 3 showing one of the shutters open, and Fig. 1 being a horizontal sectional view. The ventilators are preferably located in the bottom rail of the window frame, side recesses separated by a central rib being formed in the outer face of the rail, and a shutter being hinged to the outer end of each recess. In each recess are openings communicating with the interior of the car, and in the sash rail near the shutter hinge is a recess covered by

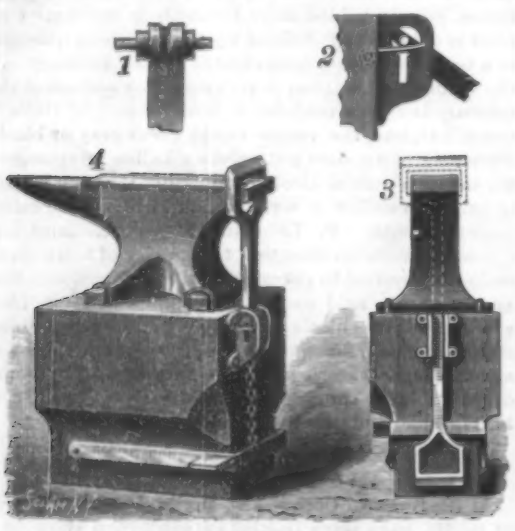


BURKE'S VENTILATOR FOR RAILWAY CARS.

a plate having a horizontal and a vertical slot, in which operate a pin and a latch. The pin passes at an incline into the hinged end of the shutter from the rear, so that the force applied in opening the shutter will be exerted in the line of its direction of movement. When the device is applied to railway cars, the shutter at the forward side of the window only is opened, the cinders, dust, etc., being then deflected from the opening. This device can be readily attached to a car after it has been built, and can be conveniently manipulated from the inside without raising the window. It is also adapted for attachment to the windows of dwelling houses, etc.

AN ANVIL ATTACHMENT.

The invention illustrated herewith provides means whereby metal may be quickly and easily bent and cut off upon the anvil, and forms the subject of a patent issued to Mr. Charles M. King, of Downieville, Cal. Figs. 3 and 4 are side and end views of an anvil having such an attachment. A U-shaped lever having a treadle at one side is pivoted to the sides of the anvil



KING'S ANVIL ATTACHMENT.

block in a cut-away portion near its base, a chain from this lever extending upward to a grooved disk on the end of an arm pivoted in a bracket. Fig. 1 shows the pivot end of this arm, and Fig. 2 the manner in which it is held and pivoted to the anvil block. The arm has at its free end a rectangular-shaped grip large enough to clasp the end of the anvil and admit a fair sized strip or bar of metal between it and the face of the anvil, and is capable of vertical movement in slots in slide flanges of the bracket in which it is pivoted. Springs at the side of the bracket hold the grip above the face of the anvil, to allow room for the insertion of the metal, until the treadle is depressed. When the foot is placed upon the treadle, the arm is raised to bring the grip into position above the face of the anvil, and by further pressure upon the treadle the grip is brought firmly down upon any metal which may be between it and the anvil, or, if there is no metal there, the grip may be brought down to a solid bearing upon the anvil, so that the triangular upper face of the grip may be used to cut the metal upon. When the grip is not in use for either of these purposes, its arm is tipped down out of the way, at the end of the anvil block.

Brittle Bodies.

Under the head, "What are brittle bodies?" Prof. Frederick Kick recently communicated the preliminary results of some very interesting experiments in *Dingl. Polytech. Journal*, 274, 405. He starts with two theses:—(1) Those bodies of substances are brittle which, in order to become ductile or plastic, must be subjected to a high pressure, acting uniformly from all directions; (2) the hardness of a substance may be determined with numerical accuracy by means of its shearing stress if every bending and every fluxion of the material particles be excluded. To substantiate the first thesis, the following experiments were made with pieces of gypsum, steatite, rock salt, and calcite, all of which are, under ordinary conditions, very brittle. The test materials were cut and ground into prismatic shape. A suitable piece of ordinary iron gas pipe was closed at one end with a well-fitting plug, and filled with molten shellac, avoiding carefully any formation of bubbles. Into this were immersed the test prisms, which had previously been coated with shellac solution, and after filling up the remaining space with shellac, the top was closed by a second plug. The pipe was allowed to cool slowly for several hours, and then bent into U-shape. In dilute nitric acid the iron pipe was dissolved, leaving the shellac core unaffected. This was dissolved in alcohol, leaving the bent prism of rock salt, steatite, etc., in perfectly coherent shape. The softer the enveloping material, the better the results. The author constructed then a simple but effective apparatus, in which oil was the enveloping medium instead of shellac, and succeeded in altering the shape of the most brittle substances without affecting transparency or coherence. In regard to the second thesis, the author's experiments are yet few in number. It seems true that the hardness and shearing stress are directly proportional, but more experiments are necessary to establish the thesis as a law of nature. Shellac and tin are substances of widely differing nature and composition. Their hardness, however, is equal, and Professor Kick finds for both the same shearing stress, *i. e.*, 2·6 kilogrammes to the square centimeter.

AN IMPROVED ADJUSTABLE LADDER.

A ladder which may be conveniently adjusted to the inequalities of the ground or other support, and which may be compactly and readily folded when not in use, is represented in the accompanying illustration, and has been patented by Mr. Pierre F. M. Burrows. The body of the ladder has four standards arranged in pairs to form the sides, and the front and rear standards of each side are filled in at their bottom ends by a block, rigidly attached to the rear standard and adapted to slide in a longitudinal groove in the front standard. The steps and the front and rear standards are held in position by bearing rods attached to the standards by a bolt or screw passed through eyes in the ends of the rods. The under surface of the steps have a transverse groove near each end adapted to receive the bearing rods, to which they are held by staples, and on the under side of the upper step is a longitudinal attached brace. The steps being thus pivotally attached to the bearing rods, the standards and steps may be readily folded close together, and when the ladder is set up the pivoted steps and rods give adjusting movements to the standards. The back stays or braces are each composed of two parallel and spaced strips, the limbs being made to interlock or cross each other, and each limb having near the top an adjusting stop, the stops being fixtures adjustable by thumb nuts according to the surface of the ground. The upper ends of the limbs are connected to the rear standards by a swivel or universal joint, and the stays are limited in their movement by a length of chain connecting them with the standards. When the ladder is to be used, it is set up perpendicularly to be opened out from its closed position, and the back stays spread from the bottom as far as allowed by the stops, the latter being adjusted accordingly when the ground is rough. When such adjustment has been properly effected, the ladder is designed to be more safe and rigid, the greater the weight of the person ascending it and the higher the ladder is mounted.

For further information relative to this invention, address Mr. P. F. M. Burrows, No. 317 Victoria Arcade, Auckland, New Zealand.

AN IMPROVED PIPE CLAMP.

This pipe clamp is designed for pipes through which a fluid passes under high pressure, serving for strengthening parts of the pipe that have become weak and for mending ruptured and broken pipes. It has been patented by Messrs. William Walker and John R. Davis, of Jermyn, Pa. The sections of pipe are united at their ends in the usual way by a socket, and a clamp to surround the joined ends is formed of two semi-cylindrical sections, with flanges adapted to receive bolts to fasten the two sections together, a packing being placed between the flanges. Each of the clamp sections has on each end a semi-annular flange, and when the pipe line extends horizontally the upper section has a conical aperture through which the molten calking material is introduced. When the pipe line is vertical, the calking material is poured through the upper end of the pipe clamp. In applying the clamp over a weak spot or disconnected sections of pipe the openings at the ends of the inclined flanges are closed by clay or other suitable packing, when the molten metal is poured to fill the interior space formed around the pipe by the clamp sections. When the molten metal has hardened, the clay or packing is removed and the operator calks the edges in the flanges with suitable tools.

WALKER & DAVIS' PIPE CLAMP.

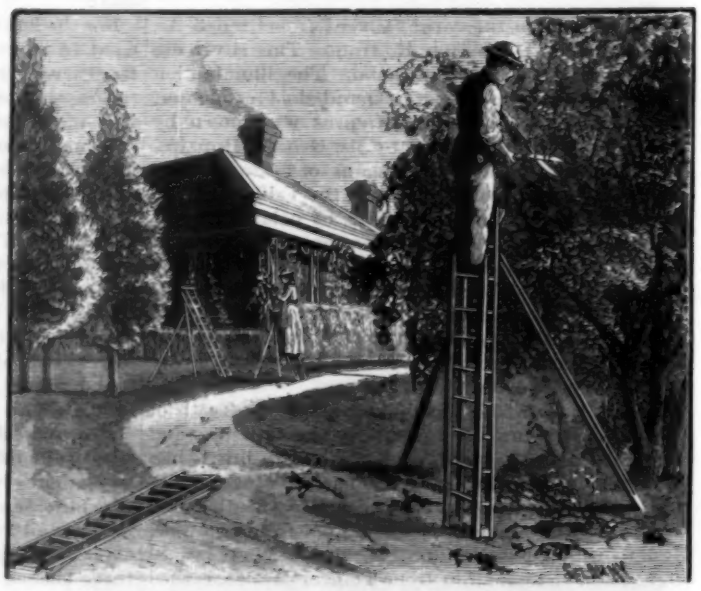
Naval Armaments.

It appears from the British navy estimates that the present Board of Admiralty have substituted as the main armament of all the battleships they have laid down guns of a smaller caliber, for they consider the 110 ton gun too large and weighty for general use, although, so far as penetration and destruction are concerned, it is the most powerful weapon in the world. Three ships only will be armed with them.

The 67 ton gun carries an armor-piercing projectile of 1,250 lb. weight, capable of penetrating at 1,000 yards a steel plate of 24·3 in. in thickness, with a bursting charge of 85 lb. in the common shell. The 110 ton gun carries an armor-piercing projectile of 1,800 lb., capable at 1,000 yards of penetrating 27·4 in. of steel, with a bursting charge of 180 lb. in the common shell.

Red Glass.

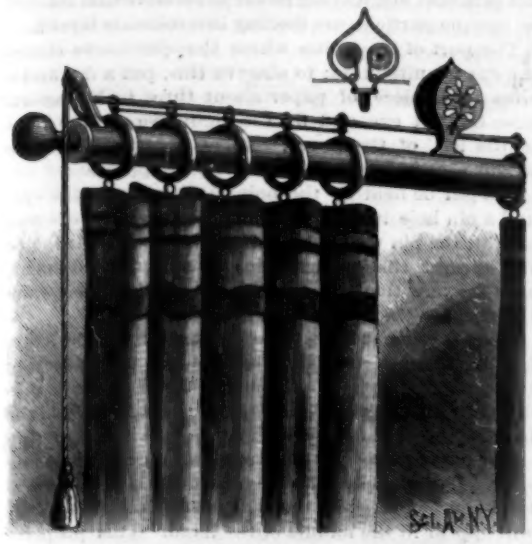
A new red glass has been recently produced in Germany. Besides its use for the manufacture of bottles, goblets, and vases of various kinds, it will be found applicable in photography and in chemists' and opticians' laboratories. This glass is produced by melting in an open crucible the following ingredients:—Fine sand, 2,000 parts; red oxide of lead—minium—400; carbonate of potash, 600; lime, 100; phosphate of lime, 20; cream of tartar, 20; borax, 20; red oxide of copper—protoxide—9; and bioxide of tin, 13 parts. By a single melting a transparent red glass is said to be obtained of a very fine quality, of which various objects can be manufactured directly, without the necessity of a second heating to intensify the color.



BURROWS' FOLDING ADJUSTABLE LADDER.

AN IMPROVED CURTAIN POLE FIXTURE.

A simple and convenient means of sliding a curtain upon the pole from which it is suspended, in such a way that the curtain will not be worn or torn, is shown herewith, and forms the subject of a patent issued to Mr. Charles H. Morgan, of West Chester, Pa. A case carrying spring rollers is attached centrally to the curtain pole, and a cord connected therewith passes over

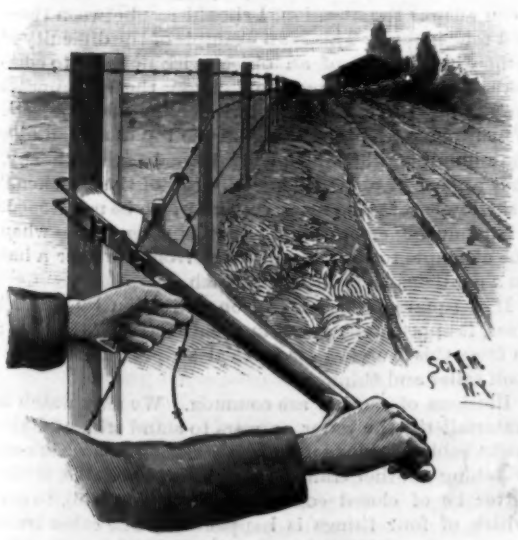


MORGAN'S CURTAIN POLE FIXTURE.

a pulley and out through the stem of the case, the cord being attached to the first curtain ring, and passing thence through a retaining piece at the end of the pole and falling at the side of the curtain, where it may be easily grasped by the hand. The curtain rings are fastened together by a separate cord, so that they will be spaced regularly upon the pole, and will all be moved by the cord connected with the spring rollers. The retaining piece at the end of the pole has a spring-held pivoted pawl adapted to hold the operating cord in any position in which it may be left at rest, with the curtains wholly or partly opened, while allowing them to be fully moved in either direction, at the will of the operator.

AN IMPROVED WIRE STRETCHER.

The illustration shows a light and conveniently manipulated device for stretching fence wires, which has been patented by Mr. John W. King, of Buena Vista, Tenn. Near the outer end of a hand lever are triangular recesses, in which is pivoted a yoke, the members of which are connected by a bar to which an outwardly extending twin hook is secured. In the rounded end of the lever are one or more teeth or pins, and a U-bar is pivoted near its end having hook-like teeth extending beyond the end of the lever, this bar being normally held folded back upon the lever. A small cutter projects from the back of the lever, and a hand bar is also hinged thereto. When a barbed wire is to be stretched it is passed through only one of the hooks, but a tape wire is to be passed through both hooks to give sufficient gripping surface. The wire being brought into engagement with the hooks, the teeth on the ends of the lever are placed in contact with the side of the post and the lever is swung around until the wire is brought up against the post, when the teeth of the U-bar, being made to engage the opposite face of the post, will hold



KING'S WIRE STRETCHER.

the lever parallel with the line of stretched wire, which may be nailed or clamped to the post in the usual way.

THE Penberthy Automatic Injector Co., of Detroit, Mich., exhibited their injector at the Detroit exposition of 1889, and were awarded therefor the only medal given in this line.

Effect of Whistling on Seals.

While reading of "Instances of the Effects of Musical Sounds on Animals," by Mr. Stearns, in which I have been much interested, it recalled to my mind apparently similar effects produced upon seals, which I often noticed during a prolonged stay in Hudson's Strait. Here the Eskimo might often be seen lying at full length at the edge of an ice floe, and, although no seals could be seen, they persistently whistled in a low note similar to that often used in calling tame pigeons, or, if words can express my meaning, like a plaintive phe-ew, few-few, the first note being prolonged at least three seconds. If there were any seals within hearing distance, they were invariably attracted to the spot, and it was amusing to see them lifting themselves as high as possible out of the water, and slowly shaking their heads, as though highly delighted with the music.

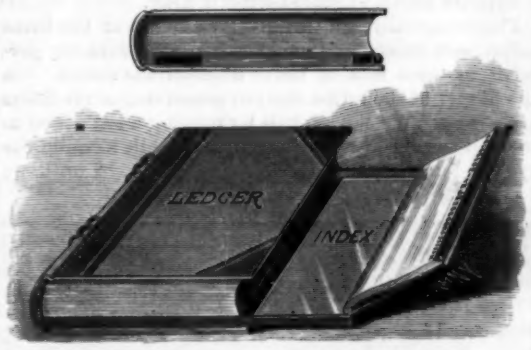
Here they would remain for some time, until one, perhaps more venturesome than the rest, would come within striking distance of the Eskimo, who, starting to his feet with gun or harpoon, would often change the seal's tune of joy to one of sorrow, the others making off as fast as possible.

The whistling had to be continuous, and was more effective if performed by another Eskimo a short distance back from the one lying motionless at the edge of the ice.

I may add that the experiment was often tried by myself with the same result.—*F. F. Payne, in American Naturalist.*

AN IMPROVED LEDGER INDEX.

A device designed especially for the convenience of bookkeepers is illustrated herewith, and has been patented by Mr. George A. Pratt, of Brownsville, Cal. To the inside of the cover of the ledger or other large book having an index is secured a suitable casing with an opening in which operates a drawer, to be held in place by a knob and catch or lock. Within this drawer is placed a separate index book, so that the bookkeeper, on pulling out the drawer, will have the index continually before him while posting, and be saved the neces-



PRATT'S BOOK INDEX AND CASING.

sity of having constantly to turn to the front of the book to find the folio for each account. The drawer is so attached to the ledger by means of catches on each side that there is no liability of their becoming separated.

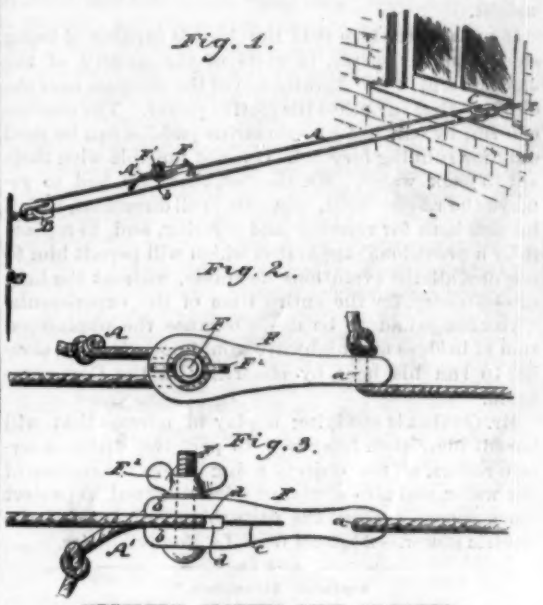
Effect of Small Bore Bullets on the Body.

The adoption of small bore rifles by most European countries—Switzerland now employing 7·5 and 6 millimeters (25 mm. being very nearly an inch), France 8, Belgium 7·6, instead of the hitherto universally used 11 mm.—leads to the consideration of what the effect on the human body will be of the increased penetration of these bullets, which can pass through iron plates of 12 mm. (nearly half an inch), and deal planks of 1·1 meter (about a yard) in thickness—a penetration five or six times as great as that of the projectiles hitherto employed in the German army. Professor Paul Bruns, the well known surgeon of Tubingen, has published a work which attempts to give an experimentally scientific answer to this important question. His experiments were made with the Belgian Mauser rifle, and the conclusions he has come to must be considered in all respects satisfactory from a humane point of view. He asserts that the hydraulic pressure in the wound is much diminished, partly on account of the smaller diameter of the bullet and partly on account of the spring action of the thin steel coating which surrounds the soft lead core of the new projectile, so that the extensive tearing of the soft tissues of the body, such as the old lead bullets used to cause—and which often gave rise to the erroneous idea that explosive bullets were employed—will not occur.

The new projectile, which, at 100 meters, passes through four or five limbs and smashes up three thigh bones, placed one behind the other, makes a smooth cylindrical opening, of less diameter than itself, through flesh. The wound made where the bullet enters is generally of less diameter than itself. The exit is a slit or a star-shaped opening, with torn edges, about 6 to 8 mm. wide. At longer ranges, 400 to 1,500 yards, the bones are not shattered, but bored through in a clean hole or channel. Hence, according to Dr. Bruns, the chances of healing bullet wounds will, notwithstanding the much greater efficiency of the new rifle, be much more favorable than in the case of the larger bores. So it would appear that in all cases progress in the art of war leads to the diminution of human suffering!—*Ueber Land und Meer.*

AN IMPROVED CLOTHES LINE ADJUSTER.

The device shown is designed to be applied to traveling clothes lines, for readily drawing the line taut, and to automatically relieve the strain incident to shrinkage after wet weather. It has been patented by Mr. Henry F. Metzler, of No. 608 Carroll Street, Brooklyn, N. Y. Fig. 1 shows the device in



METZLER'S CLOTHES LINE ADJUSTER.

use, Fig. 2 being a plan view thereof, and Fig. 3 a side view. One end of the rope is passed through the aperture, *a*, in the holder, and knotted, the other end being passed through the jaws, *b b*, and around the bolt, F', as around a pulley. The body of the holder may be of wood or metal, but is preferably of wood, and is slotted, as at *c*, to form the jaws, and recessed at *d d*, to allow space for the rope to pass. A screw-threaded common bolt may be passed through the jaws, with a thumb nut for tightening the jaws upon the rope, the grip upon the rope being made firm enough to hold it ordinarily taut, but not so close as to prevent a slight drawing of the line through the jaws to allow for shrinkage without injurious strain.

A WATER SHIELD FOR WINDOW BRUSHES.

The device shown in the illustration is adapted for convenient and expeditious attachment to the handle of any brush or window-cleaning implement, to prevent the water from passing down the handle to the hands of the operator. It has been patented by Mr. Isaac Stiner, of No. 248 East Seventy-eighth Street, New York City. The device consists of an elastic cup, preferably formed of rubber, and having an upwardly extending central conical portion, through which is an opening for the passage of the handle, there being also

STINER'S WATER SHIELD FOR WINDOW BRUSHES.

an annular flange integral with the outer side face of the cup, and an aperture or opening on one side forming a spout for the delivery of water from the cup.

THE military commission of the Austrian army have established a law that the offense of intoxication should be punished the first time by a public reprimand. The second offense by several days' imprisonment in the guard house. The third offense is evidence that the victim is suffering from a chronic disease, and he is placed under constant surveillance. His pay is taken out of his hands, and every means used to prevent him from getting money to secure spirits.

A NEW SUBMARINE BOAT.

(*Continued from first page.*)

in diameter, and weighs, all armed, 6,000 kilogrammes (13,200 pounds), thus permitting of its being carried from one end of the world to the other, like a package or a ship's launch, upon a railway truck or on board of an ironclad.

This relative lightness does not prevent its having, by reason of its lines, a wonderful trim, and of being remarkably seaworthy. When it is floating on the surface, even during a rough sea, it carries two or three men very well upon top (Fig. 2) without rocking.

The Goubet is provided underneath with a mass of lead of 900 kilogrammes (1,980 pounds), which may be freed by turning a bolt. This is termed the safety weight.

It remains to state that the boat is capable of being steered under water, in spite of the opacity of the medium and of the disturbance of the compass near the dynamo that furnishes the motive power. The Goubet can run by oar, but its submarine paddles can be used only for running forward. It is not possible with their aid to back water. Mr. Goubet, therefore, had to remove the rudder helix, movable in all directions, which he uses both for running and steering, and to replace it by a provisional apparatus which will permit him to perform all the evolutions desirable, without the help of electricity, for the entire time of the experiments. This change had to be made because the administration of bridges and highways would not allow Mr. Goubet to run his boat by electricity in the Commerce basin.

Mr. Goubet is studying a play of mirrors that will permit him, when immersed, to perceive, within a certain radius, all the objects rising above the surface of the water, and also a combination designed to protect his compass against the disturbing influence of the electric motor.—*Abstract from Le Monde Illustre.*

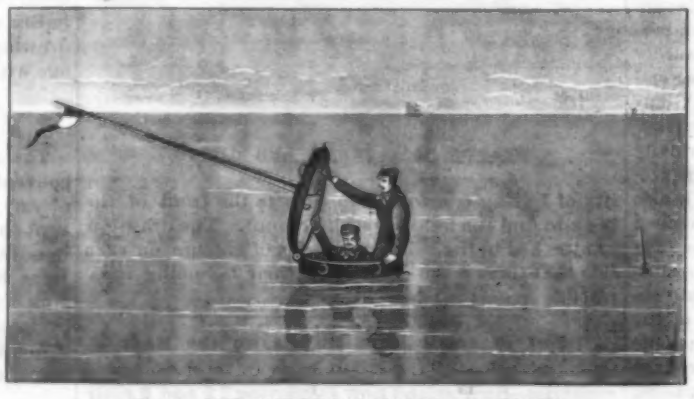


Fig. 3.—THE GOUBET PARTIALLY SUBMERGED.

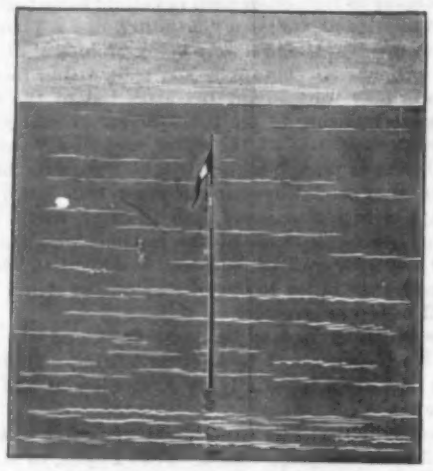


Fig. 4.—THE GOUBET COMPLETELY SUBMERGED.

Optical Illusions.*

If any one wishes to make an emphatic statement about an occurrence or thing, and says, "It must be so, I saw it myself," he considers the matter is settled. To-night I shall try to show that seeing is not always believing, and that many things we see are merely optical illusions and not to be entirely depended on as facts.

I use the term as a title in the widest possible sense, and intend including in the subject any case in which we see, or think we see, anything differently from what it is in reality. My paper will be divided, more for convenience than with scientific accuracy, into three parts. First, illusions depending on optical contrivances—reflection and refraction being the chief causes of deception; secondly, illusions depending on the structure of the eye—here we shall discuss color, irradiation, and binocular phenomena; and thirdly, optical illusions depending on the brain, or the interpretations of the sensations received by the eye. In this section I shall give instances in which the judgment is misled, and conclude with a few words on apparitions.

I.—Illusions Depending on Optical Contrivances.—Probably the best known optical illusion is Pepper's ghost. Here a plate of plane glass is placed at an angle of 45° near the front of the stage, before it the stage floor is some feet lower, and any strongly illuminated object on the floor in a horizontal position appears upright and on the stage. One of my friends recently showed me a device depending on the same principle, by which a photograph on glass is superposed on an ordinary carte.

Reflection is responsible for some of the tricks of the Davenport Brothers and for the curiosities known as living heads without bodies, etc. The converse of this may be seen in the palace of Versailles, where a combination of mirrors makes spectators appear headless.

The "optical paradox" enables one apparently to see through a brick, but really four plane mirrors carry the light round the obstacle.

In the "phantom bouquet" concealed flowers are made by a concave mirror to appear in a vase. Concave and convex cylindrical mirrors cause strange and amusing distortions of the faces of those looking at them.

Refraction makes a pond appear shallower than it is, and a stick put in water appears bent. By refraction of light through layers of air of different densities, the strange illusions known as mirages are produced.

If a wine glass is partly filled with water and inverted on a plate with a coin on it, refraction causes the coin to appear on the surface of the water, and it is also seen directly, but enlarged. By means of the double refraction of Iceland spar, a dot placed under it appears as two.

II.—Illusions Depending on the Structure of the Eye.—Several interesting illusions depend on the fact that an image on the retina lasts about an eighth of a second. In the thaumatrope a card has an object drawn on each side, say a bird on one side and a cage on the other; if the card is rotated, the images are superposed and the bird appears in the cage. In the zoetrope and the phantascope a moving object, as a swinging pendulum, is drawn in successive stages, and while the series is rotated and viewed through slits, the pendulum appears to be swinging backward and forward. For the same reason a vibrating string appears as a flat plate, and we think lightning lasts much longer than it actually does, while without this "persistence" fireworks would lose most of their beauty. The rotating vacuum bulbs form a very pretty illustration of this, but as the illumination is intermittent, the tube appears as a rayed star and not as a continuous circle.

That white light is composed of all colors may be shown by rotating a disk with segments, colored in proper proportions, when the colors are blended, and it appears white, or more correctly gray.

Physiologically, white light is made up of the three colors, red, green, and violet, which we probably perceive by three sets of nerve fibers of the retina. On the border of the retina the red-perceiving nerve fibers are absent. We can see this by holding a red pencil in front of the eye at arm's length, and while keeping the eye fixed moving the pencil round sideways, until we reach a point at which the pencil is visible but appears black. If the eye has an excess of one color presented to it for some time, the nerve fibers corresponding to that color are incapable of acting for a short period, and a white surface appears tinged with the complementary color. This effect has been largely used by a certain firm for advertising purposes. Similarly a strip of white paper on a piece of bright green covered with white tissue paper appears pink.

An ingenious advertisement has blue figures on a red ground. When these are viewed in the shadow and slightly moved, the blue marks appear to dance about the paper, for when the eyes are in focus for the red, an image for the blue is formed in front of the retina, and is therefore indistinct; when the blue is right, the red is indistinct; as the red rays converge to a point behind the retina, the rapid changing of the focus of the eye from one to the other position makes the edges indistinct, and gives the idea of motion.

If santonin is taken, white appears yellow, as this drug has the property of destroying the violet-perceiving fibers.

If a thin platinum wire is made incandescent with an electric current, its apparent thickness is greatly increased; this is due to "irradiation," or the encroaching of bright parts on darker ones; similarly, any one looks larger in light than in dark clothes, and a white wafer on a black ground looks larger than a black wafer on a white ground. The effect of background may be noticed in a snow storm; the snow looks black against the light sky, but white against the dark earth. Irradiation also explains the appearance of a pole with the sun as background, when the pole appears narrower, or even discontinuous, where in front of the sun's disk. A piece of black thread held in front of the gas shows the same phenomenon.

A defect of the eye, known as spherical aberration, causes the eye to see a bright point as a star. Gas lamps in foggy weather show this well.

Milk looks white and blood red because the eye has not sufficient magnifying power to perceive that colored or opaque particles are floating in a colorless liquid.

The part of the retina where the optic nerve enters the eye is quite blind; to observe this, put a dot and a cross on a piece of paper about three inches apart, close the left eye, and fix the right eye on the cross to the left of the paper, and at a certain distance (about nine inches) the dot entirely disappears.

If a pin be held by the point quite close to the eye, and a pin hole in a card be held between the eye and a light, the pin will appear head downward, owing to the upright shadow being inverted by the judgment, as if it were the inverted image usually received on the retina.

The experiment known as Scheiner's is curious. By looking at a pin through two holes very close together two pins are seen, as an image on the retina is produced by the rays of light passing through each of the holes.

Our having two eyes make some strange illusions possible. Let a paper tube be placed to the left eye and the hand be placed by the right side of it, when a hole will appear in the middle of the hand. This property of the brain of combining the images of the two retinas is occasionally of use in tracing the form of an object under the microscope without the aid of a drawing prism.

The stereoscope gives the appearance of solidity by combining two slightly different views by means of prismatic eyepieces. Two somewhat similar "cartes" placed under it are blended to a curious composite portrait. If two banknotes are observed in it, and there is any appearance of solidity, they are not identical, and therefore one is forged.

That our judgment of distance largely depends on having two eyes, may be amusingly shown by trying to thread a needle with one eye closed.

The pseudoscope is a combination of prisms which inverts the normal relation, and makes near objects appear distant, and *vice versa*, in a most bewildering way.

The curious rotation of "strobic circles" partly depends on persistence and partly on the fact that the curvature of the eye is not exactly the same in the vertical and horizontal direction.

Pictures must be classed as optical illusions, for all artists attempt to make objects on a flat surface appear to have three dimensions. So well is this done at times that we think the eyes of a picture follow us as we move about a room.

The effect of neighboring forms in misleading the judgment may be shown by placing two exactly equal somewhat horseshoe-shaped pieces of cardboard with the narrow part of the one opposed to the broad part of the other, when the latter will always look larger.

How big does the sun look? is a question which would get various answers; or, to put it more definitely, what is the diameter of a sphere which just hides the sun's disk at a certain distance, say ten feet? As far as I can answer the question, I should say between three and four inches. This is an example of the difficulty of estimating the size of an object with nothing to compare it with; when on the horizon, the sun appears larger, for there we may have comparison objects. When we see people walking on the top of a small hill, the summit of which is sharply defined against the sky, they appear gigantic. The "Specter of the Brocken," a shadow cast by the rising sun, may also be mentioned.

An amusing error of judgment is often made when one attempts to show the distance from the floor a hat on a gentleman's head would reach.

If a square is divided in one direction by parallel lines, it appears elongated in the direction of the lines; in dress this is useful, for vertical stripes make a lady look taller and thinner.

Illusions of motion are common. We may watch a waterfall till the water appears to stand still, and the rocks behind it move up. While sitting in a train and watching another train passing, it is impossible, if the latter be of closed coaches (like a mail train), to say which of four things is happening. The other train may be at rest, or we may be at rest, both trains may be moving in the same direction, but ours quicker, or in contrary directions. We can only settle the question by looking out of the other window.

On looking at a bright sky I can see spots moving up and down, and looking like snakes. These are known as muscæ volitantes, and are due to moving opaque particles in the vitreous humor of the eye throwing a shadow on the retina.

[The lecturer introduced other examples of optical

* Extracts from a paper read at a meeting of the Midland Counties Chemists' Association, February 18, 1890. By J. F. Liversedge, A.I.C., M.P.S.

illusions which one frequently observes, the cause of which is a mystery to him; but the above selections are among the best examples produced.—ED.]

A Balloon Ascent.

Great excitement was caused at Croydon, England, on a recent Saturday afternoon in connection with the ascent of Professor Higgins, the parachutist, and for several hours doubts were entertained as to his safety. The balloon, which had that day been named "The Duke's Motto," and which was of the capacity of 12,000 cubic feet, was fully charged by five o'clock. Higgins said the direction of the wind, which was northeast, would necessitate his traveling a considerable height, but he hoped to return to the field in about half an hour. When he gave the signal to the attendants to "let go," the balloon gradually rose and appeared to go in the direction of Norwood. Upon reaching an altitude of something like 4,000 feet, the parachute became detached from the net of the balloon, which was rising at a great rate. It was evident that something had gone wrong. The balloon rapidly disappeared in the clouds. When darkness set in and no news had been received of the parachutist, much anxiety was evinced as to his fate. Shortly after eight o'clock, however, all fear was dispelled by the receipt of a telegram stating that Higgins had landed safely near Tonbridge. Higgins returned to East Croydon by the 9:20 train. In an interview with a correspondent, Higgins stated that he had experienced the most wonderful of all his aerial voyages. When he had reached a height of 4,000 feet he began to get into a strong current, and the balloon twisted right round. The current then caught his parachute, causing the wooden ring of it to catch him very tightly under the arms. The test cord which held the parachute then broke. Directly that happened he saw that the parachute was hanging below him fully inflated, and the pressure on him was so great that it was impossible for him to descend into the middle of the town with anything like safety. He thereupon opened his penknife with his teeth and cut the parachute away. This caused the balloon to shoot up 6,000 feet higher, and, on reaching that altitude, he met another current, which brought him back, and he saw nothing until he passed through some sleet and snow. He could hear, however, the sound of trains. He was in this snow storm for at least ten minutes, and when he had passed through it the sun was shining beautifully. He could see the sun glistening on the water at Brighton. He found the air getting very sharp and keen; icicles were hanging from his mustache. For a few minutes he was quite deaf. He now seemed to be descending, and he thought he was getting near Hastings or Brighton. He could smell the sea. When he was 2,000 feet from the earth, he prepared to descend by hanging by one arm on to his trapeze rope as if he were using his parachute. When his feet touched the ground the balloon, which was in front of him, dragged him for ten yards, and then rebounded some sixty feet in the air, between two trees. Two laborers, in response to his signals, arrived just as he came down a second time, and held the balloon until he let out the gas. He found that he had landed on a farm in the occupation of Mr. Nash, at Penshurst, about thirty miles from Croydon. In reply to questions, Higgins said that at one time he must have been five miles above the earth —the highest he had ever been. He added that the balloon had no escape valve.

The Farmers' Trust.

At last the farmers have a *sure* remedy for depressed prices. A company has been incorporated in Illinois, with headquarters at Chicago, under the awe-inspiring title of the Farmers' Co-operative Brotherhood of the United States. The incorporators propose to do business with $50,000,000, which will be subscribed by the farmers. When the stock is all taken, the brotherhood will be informed by the farmers what price they desire for their grain, and the brotherhood will go into the market and push the price up to the desired point. Thus farmers can sell their grain, and buy more stock in the brotherhood, and in a short time the brotherhood will have the grain and the farmers will have the stock. The scheme is very simple and will undoubtedly prove a howling success—that is, the farmers will howl for their grain, which the promoters have successfully made away with. The Farmers' Brotherhood are to get rich by buying their own grain. The "farmers" who are in the scheme probably all live in Chicago. The curious part of this and all similar plans for increasing the price of the farmers' produce is that it utterly loses sight of the fact that the farmers of the United States do not raise all the grain in the world. In fact, any very great advance in the price of wheat, for instance, would be almost certain to bring Russian wheat to our shores, in spite of the tariff. The farmer has not had a very good time of it of late years; but his redemption will not be brought about by any such scheme as the brotherhood proposes, or the equally brilliant plan of the Detroit gentlemen who proposed that farmers could instantly double the price of wheat by burning half of their crop.—*American Miller.*

Correspondence.

Cedar Oil.

To the Editor of the Scientific American

Noticing your reply to H. W. H., in the SCIENTIFIC AMERICAN of the 19th inst., I wish to say that cedar oil is made in this vicinity by distillation, the small branches being used. As the branches can be obtained wherever the cedar grows, and as the shavings cannot be easily obtained, this may be of value to your correspondent. W. J. STANTON.

Lyndon, Vt., April 21, 1890.

Pittsburg a Great City.

To the Editor of the Scientific American:

In a late issue of your paper you published a table giving the estimated comparative rank of the cities of the United States in 1890, in which you rank Pittsburg as the fifteenth in population.

To persons familiar with the Pittsburg of to-day this seems a guess without knowledge of the facts. Intelligent estimates of the present population of Pittsburg put it at about 450,000, which would entitle it to rank about eighth, or above Cincinnati, San Francisco, or New Orleans.

The clearing house statements for the week ending 26th inst., now before me, seem to conclusively prove this. In this statement Pittsburg ranks the sixth city, being about 25 per cent above San Francisco, 35 per cent above Baltimore, 50 per cent above Cincinnati, 100 per cent above Kansas City and New Orleans, etc. It seems to us inexplainable that a city should rank sixth in business transacted and only fifteenth in population. JOHN T. FINDLEY.

Pittsburg, April 29, 1890.

Tin Roof Painting.

To the Editor of the Scientific American:

To allow a new tin roof to become rusty before being painted is like closing up the bunghole of a barrel and letting the liquid flow from the spigot. A rough surface secures the paint better, but gives the tin a start toward rusting, and the rust will sooner or later destroy it. This is based on the fact, and proved by experience, that iron once started to rust will continue on to rust, when water or dampness is present, until in time it is entirely destroyed, even though the best of paint is laid on to protect it. In these days, when the lowest and most unscrupulous bidder usually receives the contract to build, the painter can hardly be blamed for "closing the bunghole" by means of cheap iron ore paint, and allowing the tin, *that should be protected*, to waste through the spigot by rust. It is by far the better way to repaint the roof when the paint is too much flaked off, than to permit the tin roof to rust. The main cause of paint flaking or peeling off tin is owing to the polished surface, as no polished metal will properly hold paint. This accounts for painters preferring a slightly rusted roof to work upon, because it fastens the paint better, although it at the same time damages the tin. When iron ore paint hardens, it contracts, cracks, and loses its hold on polished surfaces, which increases to an astonishing degree in cold weather, where the least vibration will loosen its hold. Some of the finest and most costly Chinese paintings on polished metal have been instantaneously destroyed by that means. No competent carriage builder will allow any polished iron, axles, springs, hub bands, etc., to pass into the paint shop without previously roughing their surfaces, either by filing, grinding, or sandpapering, to prepare them for adhesion for paint. This plan is also observed by the sign painter when using sheet tin. The question now is: What paint will best protect tin on roofs? I have answered this repeatedly in former communications, and still know of nothing better than red lead ground in raw, cold-pressed linseed oil, applied the same day it is mixed, which forms the most tenacious and weather-resisting paint of all paints known to me. I treated the roofs of my factory, eighteen years ago, with two coats of red lead on both sides of the tin, having since repeated the painting of the upper side every three or four years (through persuasion) with iron ore paint. The result is, there is little flaking of the red lead, but no end of trouble from the iron ore paint, which in some places peels off from the red lead in large patches, leaving the red lead on the tin. I close with the remark, "All paints not poisonous, and requiring driers to insure hardening, are unfit for durable painting." LOUIS MATERN.

Bloomington, Illinois.

THE survey of the mouth of the Columbia River, recently made under authority of the Secretary of War, shows that great and beneficial changes have taken place upon the bar since the survey of 1885, about the time of the commencement of the construction of the jetty. The same channel depth over the bar which was available for a width of 1⅛ miles in 1885 is now available for a width of 5 miles, with indications that a much deeper channel is forming through about the middle of the bar.

An Ingenious Device for Lighting the Bottom of the Sea.

In the investigations that were undertaken by the Prince of Monaco in deep-sea soundings, an ingenious method was adopted to obtain specimens of the living creatures existing at the bottom of the ocean. The apparatus used was shown at the Paris exhibition. The cage in which the submarine animals were caught, according to *Le Genie Civil*, consisted of a cylinder of wire having three conical entrances, like those of a lobster pot, and weighted for submersion with detachable weights. It was, however, very unlikely that at these immense depths, where the darkness is practically total, any fish would voluntarily find their way into the trap, and steps were taken to attract them by a light placed inside it. Obviously, no light was available but an electric light, but to get an electric light to burn a mile or two under water was not easy.

The only resource was to supply the incandescent wire from a battery in the trap. Here, however, another difficulty occurred. It was necessary to inclose the battery, which had to be of considerable power, in a box of some kind, and as the hydrostatic pressure at such depths was six or seven hundred pounds to the square inch, it was found impossible to make a box which was not crushed before it reached its destination. At last, however, this trouble was overcome by the curious device of connecting the box with a balloon. The balloon was made of cloth dipped in India rubber, and so arranged that the air in it was in communication with that in the battery box.

On sinking the apparatus, the hydrostatic pressure, being virtually uniform all round the balloon, compressed it equally on all sides, forcing the air out of it into the battery box, until the pressure inside the box and balloon exactly balanced the pressure outside. This process went on to any extent, so that at the bottom of the sea, although the balloon was reduced by the enormous force exerted on it to a small fraction of its original size, it still kept the internal and external pressure equal. On raising the apparatus again it expanded as the pressure diminished, and brought the battery box to the surface uninjured. So successful was this device that, not content with capturing deep-sea fish, the prince and his assistants propose on their next expedition to send down a photographic apparatus and bring back negatives of the bottom of the ocean, as seen by the electric light.—*Gas Light Jour.*

Export of American Machinery.

American trade journals take it as an unquestionable fact that the export of American machinery is increasing. The demand from abroad, they say, for American textile machinery has of late been more active than ever before, and is undoubtedly to be attributed to the numerous patented improvements that have been and are constantly being added to American machines for cotton and woolen manufacturing, and which are now bringing them prominently to the front. These devices, the result of American ingenuity and invention, have been patented both in America and foreign countries, thus fully protecting the rights of inventors and manufacturers, and foreigners are not slow to recognize their merits. In the case of the American loom this is especially true, for it is generally thought that for speed and good workmanship combined it is superior to all its foreign rivals. As a result it is being gradually introduced in many English factories, where practical test has clearly demonstrated its uses. In the United States the ring spinning frames are largely taking the place of mules in many of the mills, and they are now beginning to force themselves upon the attention of foreign manufacturers, who, though slow to adopt new methods, and conservative in the extreme, cannot afford to neglect any improvements, from whatever source they may come, which will give them any advantage, however slight, over their competitors. The same is true with regard to many other machines used in the textile industry, in which the inventive genius of the New World has suggested valuable improvements over existing methods, and which are certain to come to the front in foreign countries as soon as their value is appreciated. During the past twelve months the value of cotton and woolen machinery exported from Boston alone has amounted to nearly $325,000, which shows an increase of almost $100,000 in comparison with the year previous.—*London Engineering.*

Electricity in the Home.

Prof. R. H. Thurston, in a recent article, gives a graphic description of what electricity will do in the near future. He says it will break up the present factory system and enable the home worker once more to compete on living terms with great aggregations of capital in unscrupulous hands. Great steam engines will undoubtedly become generally the sources of power in large cities, and will send out the electric wire in every corner of the town, helping the sewing woman at her machine, the weaver at his pattern loom, the mechanic at his engine lathe, giving every house the mechanical aids needed in the kitchen, the laundry, the elevator, and at the same time giving light, and possibly heat, in liberal quantity and intensity.

THE ACCIDENT TO THE STEAMER CITY OF PARIS.

The accident to the machinery of the great steamer City of Paris, which took place on March 25 last at sea, off the coast of Ireland, on her outward voyage from New York, has occasioned much comment and inquiry in engineering circles. The wreck of the great engine, 10,000 h. p., was complete. Almost in an instant it was transformed from an organized and beautifully working system into a chaotic jumble of bent and distorted fragments.

The first and apparently most correct reason given for the accident was the breaking of the propeller shaft, the sudden fracture of which was supposed to have produced a racing of the engine, by which it was torn to flinders. The cause of the breaking of the shaft was said to be due to the wearing of its outer bearings. *Engineering* gives a detailed explanation, from which we give a few brief extracts, with an engraving:

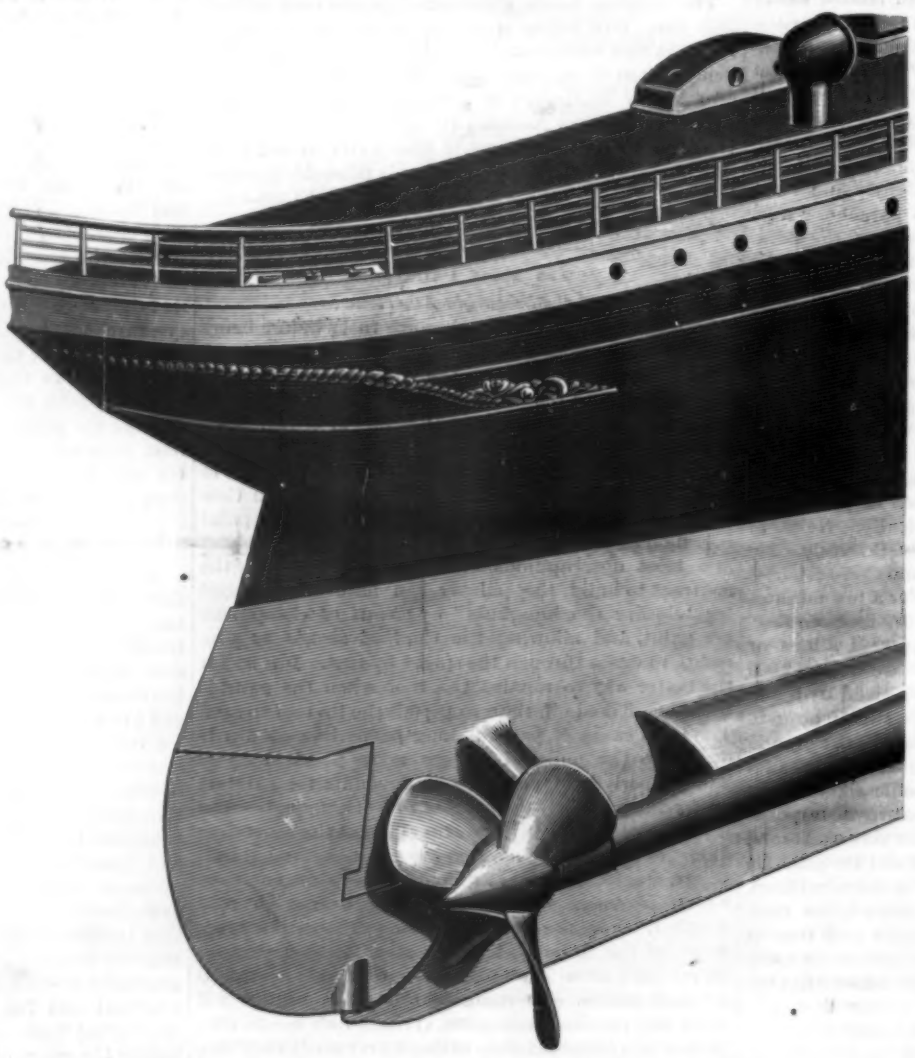
Each of the twin shafts passes through the ship's side through a stern tube in the usual manner. Immediately outside there is a flange coupling of the ordinary description, by which attachment is made to the outboard length of shafting. It was immediately on the forward part of this coupling, and therefore directly outside the stern tube, that the starboard shaft was broken square across. The position of this fracture is not shown in our engraving, it being somewhat forward of the part illustrated. The diameter of this part of the shafting is 20¼ in. The fracture was thick with rust on both faces, but there was every appearance of the metal being sound throughout and of excellent quality. On the whole, we should judge the shaft to be an excellent job, and the fracture to be entirely unconnected with any fault in the material. The outboard portion of the shaft abaft the coupling just referred to consists, we may say, of one length of hollow shafting 42 ft. long, and one length of solid shaft 15 ft. long, this latter length carrying the propeller. The total length of shafting abaft of the point of fracture was thus some 58 ft. or so.

This breakage of the shaft will of course fully account for the racing of the engine, while the subsequent damage done thereby can, we think, also be fully accounted for by causes we shall explain. Proceeding aft in our examination of the vessel, we found the two arms of the stern bracket intact, their attachment to the vessel being undisturbed. At their outer ends they are, or rather were, connected by a cylindrical boss which forms the support in which the propeller shaft revolves as shown. This boss, with the two arms and their palms by which they are attached to the hull, form one steel casting in the usual way. The thickness of metal in the cylindrical part is 3⅛ in. This boss was fitted with the usual gun metal bush and lignum vitæ bearing strips. The cylindrical part of the casting was split clean across the top in a line with the axis. The reason of this was obvious; when the forward end of the broken shaft had commenced to fall, owing to losing the support of the casing, a twisting moment of considerable force was naturally exerted, and this the casting was unable to sustain. The length of the cylindrical part of the bracket is about 6 ft.

The top part of the bracket was split across when the twisting strain was brought upon it by the release of the forward end of the outside shafting when the casing was cast adrift in the dock. It should be stated that the fracture was quite bright and free from rust, showing that it had recently been made. It will be further evident that the cylindrical part of the casting could not be intact on its bottom side, or the shaft would not be released. There was, however, no occasion for any fracture to occur here throughout, and this brings us to the most interesting part of our report. The bottom part of the casting was worn through for nearly the whole of its length, and much reduced in thickness where not worn through. The metal liner, 1 in. thick, together with its end flanges, was also worn through, and was lying in the bottom of the dock. The brass sleeve of the propeller shaft had entirely disappeared, with the exception of two rings, presumably the collars at the end. The propeller shaft itself was practically undamaged, but the metal studs which attached the sleeve to the shaft were worn down level with the shaft, and the shaft was slightly worn also.

This wearing away and consequent dropping of the end of the outer shafting we take to be the obvious primary cause of the whole mischief.

We will now proceed to give some detailed account of the damage done inside the vessel, as revealed during our examination. Passing through the starboard engine room—not without risk of broken limbs as we scramble over the debris of the low pressure engine—we enter the dynamo room, which is placed immediately abaft the engine rooms, and thence proceed to the starboard tunnel. Here we find the shafting supported by four bearings, and in each case the caps have been broken off; but, so far as we could perceive by aid of a dim light, no damage had been done to the shaft. The brake strap lugs had been broken off, but there was no sign of more than ordinary wear upon the flange on which the strap engages. The journals of the shafting were also in good condition. At the transverse partition forming the forward end of the tunnel, the plating was torn and doubled up to a height of about 6 in. above the shafting. In the dynamo room, through which both port and starboard shafts pass, there are two bearings to each shaft; both of those belonging to the starboard shaft have their caps split. From what has been said it will be gathered that the shafting must have risen bodily when the accident occurred; but, as the stern tube is intact in its position, so far as our observation went, there must have been some bending of the shafting. The couplings of the various lengths have, however, stood the test.



STERN AND SCREW OF THE S.S. CITY OF PARIS.

The London *Engineer* gives a different theory respecting the cause of the accident, namely, it was due to the lifting of the screw shaft out of its bearings in the engine room; and the breaking of the shaft, which took place afterward, was occasioned by the momentum of the great propeller, on the sudden stoppage of the engine.

"We find," says the *Engineer*, "that the screw shaft was lifted up out of its bearings from end to end, and the lifting up has been of such a character as to prove that the lifting effort occurred in the engine room. The screw shaft is secured to the end of the crank shaft in the usual way by a cheese coupling and bolts. The crank and screw shafts were virtually all one from the forward end of the engine room to the stern tube. The cap bolts of the after bearings on the crank shaft, although 5 in. in diameter, are broken off short, but the cap bolts of the other bearings are intact. Proceeding aft, we find that the cap was torn off the thrust block and the horseshoes scattered about the engine room. From this, back to the stern tube, all the keeps were torn off, save the last. It is perfectly clear that the screw shaft was lifted up in the engine room, and that for the moment it was several inches higher in the engine room than it was at the stern tube. How, it will be asked, was it possible that the shaft could be so lifted, while the crank shaft to which it was secured remained tied down? The answer is curious, and yet simple. The crank shaft is built up. Let us suppose that while the low pressure crank was descending, which would be the case when it was pointing to the ship's side, the screws revolving outboard at the top, some obstruction got under it and stopped it suddenly. The momentum of the heavy screw would tend to cause the shaft to revolve round the crank pin. This it could not do without bursting up the keeps, and even then either the web must slip round on the crank pin or it must twist the pin. Now, in point of fact, the pin has not been twisted, but the crank web has slipped round on the pin, and the screw shaft center is no longer in line with the crank shaft center. It is abundantly clear that something occurred to stop the revolution of the shaft; but further evidence is supplied by a great score in the crank web, due, apparently, to collision with some obstacle.

"But it may be said all this is no doubt true, but the obstacle was something which fell into the crank pit after the engine broke down from racing. A little reflection will show that this proposition is, standing alone, untenable. The screw shaft must have had some powerful twisting force acting on it from the after end, and that could only have been supplied by the momentum of the propeller. Nothing forward of the after crank shaft bearing could have ripped up the screw shaft all along the alley. That resulted from the effort made by the shaft to revolve about a new center when the crank was suddenly stopped; but no rotative effort forward of the after crank shaft bearing could, as we have said, have brought about a lifting effort of the kind wanted. This seems to us to be almost conclusive evidence that the screw shaft did not break until after the engine gave way.

"We are now in a position to advance an explanation which, though not complete, goes some little way toward completeness. The screw shaft was no doubt injured by bending, as we explained last week. The breakdown was brought about by some obstruction which prevented the rotation of the crank shaft. The screw then ripped up the shaft out of its bearings, and the weakened tail end, being unable to bear the strain, broke. The sudden jerk on the guides was, of course, tremendous. The connecting rod was bent, and the steel frames were, by the side effort, snapped off short at the bed plate.

"The question remaining for solution is, What caused the obstruction to the rotation of the crank? This is a point which may or may not be cleared up in the future. We have no certain solution to offer, nothing, in fact, more than a guess, which must be taken for what it is worth. The low pressure piston was a steel casting, with a thin coned body and a heavy rim to take the packing. In such a casting it is almost impossible to eliminate severe initial stresses, set up during cooling. The cracking of large pistons is an exceedingly common occurrence, and we could cite more than one recent case where a thin conical piston has parted from the rod. If the piston broke, and a large portion of it fell to the bottom of the cylinder, the remaining portion coming down on this would cause just such a jar as was needed for the lifting of the screw shaft in the way we have described. The bursting of the cylinder would take place at the same instant.

Regulation of College Athletics.

The University of Pennsylvania authorities have at last taken a hand in college athletics, and hereafter the students will be more restricted in the various sports. A set of rules, drawn up by a committee consisting of several of the faculty and representative undergraduates, will in the future govern all college contests:

Among the rules is this: No student whose general average in the mid-term or term report is below "medium" shall be permitted to engage in any university athletic contests or match rowing races, or play in any match games of base ball, foot ball, cricket, tennis, lacrosse, etc.

The City of Paris.

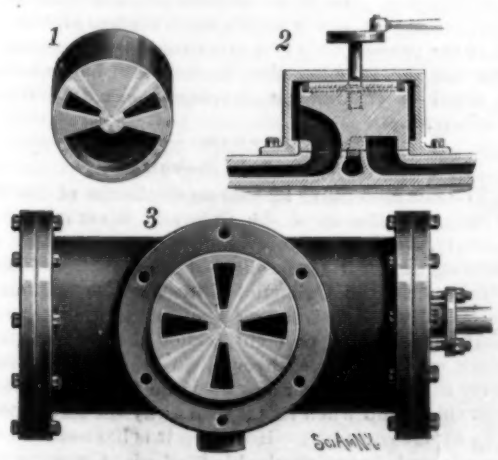
Iron concludes that, whatever may have been the immediate cause of the breakdown of the starboard engine of the City of Paris, considerable may be learned from the accident. In the first place, the transverse bulkheads have proved their ability to keep the vessel

Fig. 1.—ETCHED IRON CASKET IN THE BAVARIAN NATIONAL MUSEUM IN MUNICH—THE END.

afloat, although both engine rooms were filled with water. Secondly, the longitudinal bulkhead between the port and starboard engine rooms was not strong enough to prevent an accident to one from rendering the other engine useless. This bulkhead should be strengthened, so that each engine room should be practically bomb-proof against the other. Finally, there should have been valves in the circulating pipes between the engine room and the hull, which could be shut from the upper deck in case of the breakage of these pipes in the engine room. This would perhaps have prevented the filling of the engine rooms with water. It is a great satisfaction to know that the accident was not attended with loss of life, and that the vessel did not go to the bottom even after it reached Queenstown harbor.

AN IMPROVED VALVE.

The illustration shows an oscillating valve, patented by Mr. John C. Wood and Caleb F. Houston, designed to permit the easy reversing of the engine and obviate the wearing of a hollow seat when set to cut off at short stroke. Fig. 1 represents the valve in perspective, Fig. 2 being a sectional side elevation of the improvement as applied, and Fig. 3 showing the cylinder. The engine cylinder has the usual inlet and outlet ports opposite each other, over which operates the circular valve, turning in the steam chest, and in the valve, at angles to each other, are ports adapted to connect alternately with the live steam ports, and extending through the rim of the valve, as shown in Fig. 1, so as to lead into a circular steam space in the steam chest. In the under side of the valve is an exhaust cavity adapted to alternately connect the inlet ports with one of the exhaust ports, according to the direction in which the engine is running. The valve has a central spindle carrying a slotted link pivotally connected



WOOD & HOUSTON'S VALVE.

with a rod connected with the engine-driving shaft, to impart an oscillating motion to the valve, the pivot of the rod on the link being adjustable for governing the cut-off. The motion of the valve can be reversed by connecting the rod to the other end of the link. In the top of the valve is an annular groove in which fit a number of split rings forming a packing.

For further information relative to this invention address Mr. Caleb F. Houston, Albuquerque, New Mexico.

ETCHING.

ETCHING METALS.

There are two ways of etching metals, which produce different effects. According to one method, the design is cut, while the ground remains bright. According to the other method, the ground is etched, while the design remains bright.

Lines may be formed on any of the base metals by coating the surface thinly with beeswax, scratching the design through the wax by means of a needle or any sharp instrument, finally applying to the surface a solution formed of 1 part of nitric acid, 1 part of sulphuric acid, and 8 parts of water.

Usually a rim of wax is placed around the surface to be etched, to confine the acid. After the surface has been sufficiently etched, the acid solution is poured off, the surface is washed with water, and dried, when the wax is removed by a cloth after the metal has been heated sufficiently to soften or melt the wax.

To produce an etched ground with a bright figure, this method is reversed, *i. e.*, the design is drawn with asphaltum varnish, and the ground is exposed to the action of the acid.

In Fig. 1 is represented the end of an etched iron casket of the sixteenth century, which is an example of this kind of work. After the etching is complete the work is washed as in the other case, and the asphaltum is dissolved off by means of a cloth wet with turpentine, leaving the design bright.

GLASS ETCHING.

Glass may be etched as readily as iron or steel. The method is about the same, the only difference being in the kind of acid employed.

The glass to be etched is completely coated with

Fig. 2.—ETCHED GLASS.

beeswax or paraffine, and the design is traced thereon by means of a needle or narrow scraper, which cuts through the wax, and exposes the surface of the glass. The next step in the process is to prepare the hydrofluoric acid for use. A gutta-percha or lead bottle is required for containing this acid. It may be bought in the concentrated form, or it may be purchased in a dilute state ready for use. The strong acid should be diluted with 8 or 10 parts of water. The article may be dipped in the acid, or the acid may be applied by means of a brush, as shown in Fig. 3.

The surface will be sufficiently etched in four or five minutes. After etching, the glass is washed in water and dried, when the wax coating is melted, and removed by means of a cloth. The design will appear as a dull or frosty surface.

The operator should be very careful to avoid inhaling the fumes of the acid, and also to avoid touching the skin with it, as it produces painful ulcers, which are long in healing.

It is obvious that beautiful designs may be made in this manner upon window screens, lamp shades, mirror borders, etc.

Laying Pipes under Water.

Mr. F. S. Pecke, a civil engineer at Watertown, N. Y., lately accomplished in a very simple, cheap, and expeditious way what is usually a difficult and expensive operation—the laying of a long line of pipe in deep water. He had occasion to lay nearly 1,000 feet of suction pipe at Rouse's Point. The water was needed for manufacturing purposes, and as it was found that water near the shore was more or less roily and impure, it was necessary to place the inlet a considerable distance out in the lake. He purchased for the purpose a steel pressure pipe of 8 in. diameter, manufactured by the Spiral Weld Tube Co., at East Orange, N. J., and used for couplings cast iron flanges, weighing, with bolts and gaskets, about 65 lb. to the pair. Plugging the end of the first length, he pushed it out on the surface of Lake Champlain, and connected the second length, pushing this out in turn, until the whole line was coupled. It then presented the unusual spectacle of a line of 8 in. pressure pipe nearly 1,000 ft. long, floating with a displacement of only 3½ in. of its

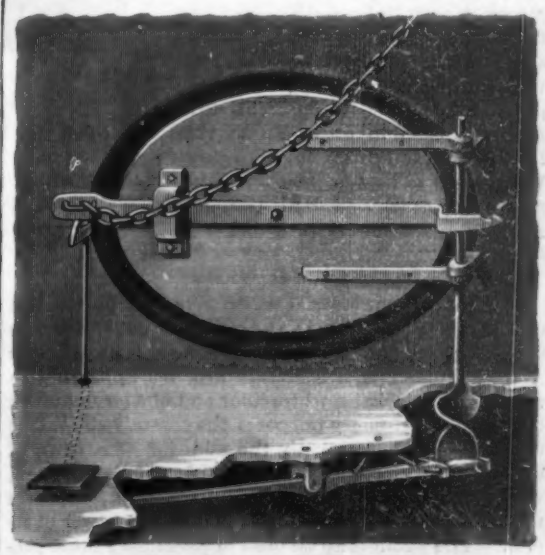
Fig. 3.—ETCHING GLASS.

diameter. When the requisite length had been connected the line was towed to position, the plug at the end removed, and the pipe sank easily in 16½ ft. of water without breaking a joint or receiving any injury. No buoys or floats were used in the operation, and no apparatus of any kind. The pipe is now in use as the suction of a steam pump, and gives perfect satisfaction. Work of this kind usually involves the use of expensive and troublesome flexible joints, and Mr. Pecke's neat and ingenious expedient is worthy of record and of imitation under like conditions.

It is obvious, says *Engineering News*, that this could hardly have been done with cast iron pipe, on account of its rigidity and liability to fracture.

AN IMPROVED FURNACE DOOR OPENER.

A device designed to facilitate the opening and closing of furnace doors, and especially adapted for application to the doors of locomotive furnaces without any alteration in the present ordinary forms of construction, is shown in the accompanying illustration, and has been patented by Mr. George F. Moors, of Owensborough, Ky. Beneath the floor in front of the furnace is pivoted a lever, one end of which terminates in a treadle extending above the floor, while the other end has horizontal aligning rollers adapted to engage the twisted lower end of a vertical shaft with which the rear end of the furnace door is rigidly connected, whereby pressure on the treadle end of the lever, moving the rollers up on the spiral of the shaft, will swing open the furnace door. When the pressure on the treadle is removed, a spring returns the lever to its normal position and thus closes the door. Another lever is also so pivoted that the pressing down of the



MOORS' FURNACE DOOR OPENER.

treadle gives vertical movement to a rod on the upper end of which is a shoulder normally resting in the bottom of the latch catch, whereby the latch bar is released simultaneously with the movement of the lever for opening the door. The latch bar extends all the way across the furnace door and has on its rear end a catch adapted to engage a similar catch projecting from the wall of the furnace at the rear end of the door, whereby the door may be held open when desired after the pressure has been removed from the treadle.

A GIGANTIC PLANT FROM SUMATRA.

(Amorphophallus Titanum.)

In the year 1878 the well known Italian botanist and explorer, Beccari, discovered, on the island of Sumatra, a gigantic plant belonging to the Arum family, and which attains a height of about 10 feet there. From seeds which Beccari brought back to Europe, some young specimens were raised in the Botanical Garden at Florence, one of which was sent to England and was cultivated in the celebrated Botanical Garden at Kew. In the course of the year this exotic reached a remarkable size, being nearly 6 feet high. Our illustration gives a correct idea of the immense plant, which, as the reader will see, has a spathe similar to that of the wake robbin and our so-called leaf plants. From the spathe rises the great spadix bearing the flowers.

On Sumatra, another gigantic plant (*Rafflesia Arnoldi*) also grows, the open flower of which measures fully three feet in diameter. These plants are parasites growing on the roots of wild vines in places where the ground is enriched by elephant manure. When the buds break through the wood of the vine roots they are no larger than a walnut, giving no hint of the great size of the future flower. Gradually, however, these buds attain the appearance and size of a head of white cabbage. About this time the outer leaves, which envelop the flower, turn back, and the latter appears. It has five large holes which surround the middle cup-shaped part. The Rafflesia described has not been found outside of Sumatra. On Java, Borneo, and the Philippine Islands there certainly are Rafflesias, but they do not attain the size of the plant which is a native of Sumatra.—*Illustrirte Zeitung.*

THE GREAT LILY OF SUMATRA.

The Smallest American Railway.

The most diminutive railroad in all Down East, according to a newspaper exchange, is that owned and operated by the Monson, Maine, Slate Co., running from the company's quarries to Monson Junction, on the Bangor and Piscataquis. This little road has a 2 ft. gauge, is about 6 miles in length, and is thoroughly equipped with locomotives, passenger, baggage, and freight cars, has several stations, regular time tables, and a superintendent. The superintendent is also conductor, baggage master, mail agent, passenger and freight brakeman, news agent, and director—a regular Pooh Bah—and for performing all these offices he gets $900 a year. Ten men constitute the entire force of the road. The trains average about 50 miles a day in summer and 25 miles in winter. The road is all down hill one way, so that a car will run from the quarries to the junction without the assistance of a locomotive. If a passenger misses the regular train, $5 will secure a special to carry him over the line. Last year this toy road carried 9,000 tons of the company's freight to Monson Junction (6 tons to a car) for transshipment over the Bangor and Piscataquis to Bangor and points west, and 4,200 passengers, who paid $12,000 in fares, were transported at a cost of $9,000. This little road has been in operation six years, and in all that time no accident of any kind has occurred on its line. We judge it to be the smallest independent line running regular trains for both freight and passengers in America.

Artificial Musk.

The first French journal which gives any particulars of the artificial musk is the *Journal de Pharmacie d'Alsace-Lorraine.* In a recent issue this paper says: Artificial musk is a chemical product appearing in crystals of a yellowish white color and of a strong musk odor. For perfumery purposes the crystals should be dissolved in alcohol, with the addition of a trace of ammonia or carbonate of ammonia. This solution, which may be compared to tincture of musk, surpasses the latter in the intensity and penetrating power of its odor. The product to be used in perfumery must previously be diluted in a homeopathic manner. The following are the rather loose details of the manufacture of the article which have been deposited with the German Patent Office: "Boil in a reflux condenser toluol or toluene, C_7H_8, with one of the following halogen compounds of butyl, viz., chloride, bromide, or iodide of butyl, along with chloride or bromide of aluminum. The resulting product falls back into the water in the still, where it is decomposed and is distilled in a current of water vapor. The parts which distill between 170° and 200° are collected separately, and treated with a mixture of nitric and fuming sulphuric acid. The product obtained from this process is washed in water and redistilled in alcohol, from which the 'artificial musk' crystallizes out." The patent rights for France and abroad have been disposed of to a syndicate of manufacturing perfumers. There is no doubt that the trade in natural musk, so far as the perfumery branch is concerned, is threatened with a very serious crisis. The use of musk in medicine is very restricted, the article being now only employed in certain cases of typhus.—*Chemist and Druggist.*

The Speed of Vessels in the British Navy.

In recent years naval officers have made themselves heard as regards the constructive details of our war ships viewed as fighting machines, and in none have they been more emphatic than in that relating to speed. The purport of their argument has been that, if a vessel has not a preponderating influence in armor and guns to enable her to give battle with some chance of success, she should certainly be provided with a high speed to show a clean pair of heels if desirable. It was no easy task to move aside the antiquated notions of the Admiralty in this respect. Other powers were, however, so pronounceably ahead of us on this question, that example and argument at length prevailed. Fast cruisers of 18 knots and higher speeds were built, and have met with all the success that was to be expected from them. Why this important factor of naval construction was neglected for so long was, and is still, a mystery to outsiders. Yet, when put to the test, we out-distance our competitors, and probably possess to-day the fastest ships of any navy. Premising, then, that speed is the first element of safety that an unarmored man-of-war can possess in a critical moment, and ranks before roominess, sail carrying power, or handiness, of which we used to hear so much in the past, how comes it that several small vessels have been built lately to crawl along at a top rate of 12 knots on a trial trip? True, these vessels are small —800 to 1,000 tons only; but they would seem to have been designed for peace purposes, fishery duties, river work, and for being kept on show instead of use were war to break out. Do the responsible authorities think enough has been done for the national honor, with all the confidence reposed in them, when attention is paid only to the leviathans in the service, and are the small craft beneath their notice? The great success that torpedo boats have had proves that moderate sized vessels may be made to travel at a pace unknown to us twenty years ago. There is, therefore, no doubt that vessels of say 180 ft. long can be driven at much higher speeds than that quoted—in fact, there are examples to prove this in foreign navies. How comes this apparent retrograde step, then, at a time when the country has been so lavish in its expenditure on its fighting fleet? We are very much afraid the answer is the old one for which public departments are noted in every country—viz., red tape. This word may be said to embrace everything that may be included with love of tradition, circumlocution, and general desire how not to achieve results. Perhaps the British government excels all others in the capacity of requiring to be goaded before it can make perceptible progress.

Let us consider for a moment what low speed in an unarmored man-of-war really signifies. Take, as an extreme case, an ordinary cargo boat, with no protection and no propelling power. In the presence of an enemy's cruiser she would be inevitably captured at once. It would seem to the uninitiated mind that a ship without armor is very much in the same category as the merchantman, and to be of any value as a guard she ought to have the power for a surplus speed and the latest ordnance. It will be seen that this rule applies more to the cruiser type than to line-of-battle ships. In the former case we have a class that would be employed in time of necessity as patrols and convoys, and thus our merchant navy would be relying on a myth were the question of speed left out of consideration. That swiftness in a scout is a *sine qua non* goes without saying. What, then, with no want of funds at our disposal, can be the object of putting our officers and men at a disadvantage if they should be called upon to do their duty to the country? It is difficult to find any answer except the one we have given. To attack or defend at will, to keep the sea for a length of time, to overcome bad weather, and be an efficient protection to commerce, means, in a few words, large engine power; but our board of Admiralty reverses the ruling of the saying that "to be at peace we must be prepared for war," and sends to sea war ships prepared for peace only, as far as speed is concerned. Officialdom reigns supreme, and the public is hoodwinked. Even a tyro at marine design will know that, as we have torpedo boats of 130 ft. long steaming at over 20 knots, vessels of a substantial build may be propelled at more than 11 to 12 knots with ordinary draught. If the type taken be that which has obtained in the service in the past, the result is inevitable; but, with the experience that has come to us during recent years, most of the shipbuilding firms of the country would readily make themselves answerable, on a displacement of 1,000 tons, for a speed of 16 or 18 knots. The remark that such a vessel would be all engines and ordnance is beside the mark, for a vessel of this kind is a weapon of offense and defense, and it is absurd, if nothing else, to furnish a war ship worthy of the name with anything short in either of these necessary vital elements. It may be said that our constructors do not have the direction of the leading features of a design in their hands. If this be the case, why does not a protest go forth against unnecessary interference? The public look to be well served, and will, if a catastrophe occur, not be slow to fix the responsibility on the shoulders of individuals. It can be easily understood that a catastrophe is within the bounds of probability if, in the present state of marine engineering, a man-of-war can only take her place in the line of battle having a speed of 12 knots as developed on a trial trip.—*Industries.*

Nevada's Salt Mountains.

The salt mountains located on the banks of the Rio Virgin, an affluent of the Colorado River in Lincoln County, Nev., cover an area of twenty-five miles, extending to within seven miles of the junction of that stream with the Colorado. The salt they contain is pure and white and clearer than glass, and it is said that a piece seven or eight inches thick is sometimes clear enough to see through to read a newspaper. Over the salt is a layer of sandstone from two to eight feet thick, and when this is torn away the salt appears like a huge snowdrift. How deep it is has not yet been ascertained, but a single blast of giant powder will blow out tons of it. Under the cap rock have been discovered charred wood and charcoal, and matting made of cedar bark, which the salt has preserved, evidently the camp of prehistoric man.

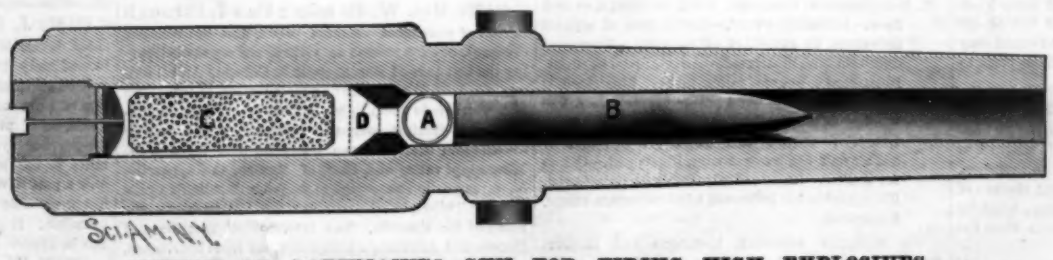
A FATAL explosion of an oxygen cylinder occurred on the 23d January at the Rosehill works of the Scotch and Irish Oxygen Company, Polmadie. While the foreman was in the act of carrying a cylinder, it unaccountably exploded with great force, injuring him fatally. Portions of the cylinder were afterward found a quarter of a mile off, although fences had to be penetrated in their flight.

The Strength of the Limpet.

Some interesting results of a naturalist's inquiries are sent to the London *Daily News* by Mr. J. Lawrence-Hamilton, who says that, in proportion to its size, the limpet is probably the strongest of known animals, excepting the Mediterranean *Venus verrucosa*, a cockle-like creature, which pulls 2,071 times its own weight when out of its shell. "At Folkestone, by means of accurate appliances," says Mr. Lawrence-Hamilton, "I found that the common seashore limpet, which, deprived of its shell, weighed a minute fraction less than half an ounce, required, when pulled according to its plane of adhesion, a force exceeding 62 lb. to remove it from its powerful grip upon the local littoral low tide rock, or upward of 1,984 times its own dead weight. The superficial area of the base of this individual limpet measured 2·4 square inches. Taking the atmospheric pressure at 14·7 lb. to the square inch, this would even then only account for 35·28 lb., or little more than half the power exercised in the air by this sea snail, which, acting upon immersed objects in the water, would, of course, have pulled a much greater weight than that of 62 lb. Thus, in the air, a limpet pulled up to 33 lb., but subsequently, in spite of its previous fatigue, when covered by the incoming tide, it then took upward of 54 lb. to remove it. I doubt whether the limpet's adhesive force has anything to do with the question of atmospheric pressure. In other experiments, even bits of rock came away sticking to the limpet's embrace. An ancient Greek author compared this animal's adhesion to the ardent attachment of an ugly old woman to a handsome youth. In carrying out my experiments upon the limpets, I was ably assisted by the eminent practical scientific naturalist, the Hon. Walter Rothschild." The same correspondent says: "The force required to open an oyster appears to be 1,319½ times the weight of the shell-less creature."

A NEW GUN FOR FIRING HIGH EXPLOSIVES.

We give an illustration of a new method of loading and constructing ordnance, lately patented by Mr. L. Gathmann, a Chicago manufacturer. The object of this invention is to facilitate the throwing of large masses of high explosives a long distance, to effect which highly compressed carbonic acid gas is placed in a cylindrical case, A, between the projectile, B, and the powder charge, C, this non-combustible gas being designed to protect the shell from heat and also act as a cushion, thereby protecting the projectile filled with high explosives from any severe shock. The invention further consists in placing a ring, D, against a specially constructed shoulder in an enlarged powder chamber. This ring, D, is made of celluloid and has a center opening considerably smaller than the inner bore of the cannon. In discharging such ordnance the ring, D, is designed to retard, in the first moment, a great amount of the powder pressure, so that the full force cannot act at once upon the projectile, but will give a slowly starting and gradually accelerating propulsion. The opening of the ring quickly enlarges, being made of strong but very inflammable material, and before the projectile leaves the muzzle of the gun the ring almost entirely disappears. By this method the action of the gunpowder is converted in the first moment into a pushing power on the projectile, without, however, losing any of its force, it being designed that the shell or projectile shall get as much pressure before leaving the muzzle of the gun as if the ring, D, and case, A, were not inserted. The shell of the projectile or torpedo can be made very light, as it is thus protected from shock and heat, thereby giving room for large quantities of high explosives. By this method it is claimed that eight inch ordnance can throw a shell containing over one hundred pounds of the most powerful explosives a further distance than has heretofore been possible, so that one shot properly directed would sink any ironclad afloat. During the last few years large sums of money have been expended by foreign powers in perfecting torpedo boat service, but the most perfect torpedo of to-day yet leaves much to be desired. By this invention it is claimed that a torpedo containing almost any desired amount of explosives can be thrown several miles. Pneumatic guns have heretofore taken the lead in this field, but they have thus far been adapted for only a short range fire, while, if this invention fulfills the requirements claimed by the inventor, all modern ordnance can be converted into guns for firing high explosives.

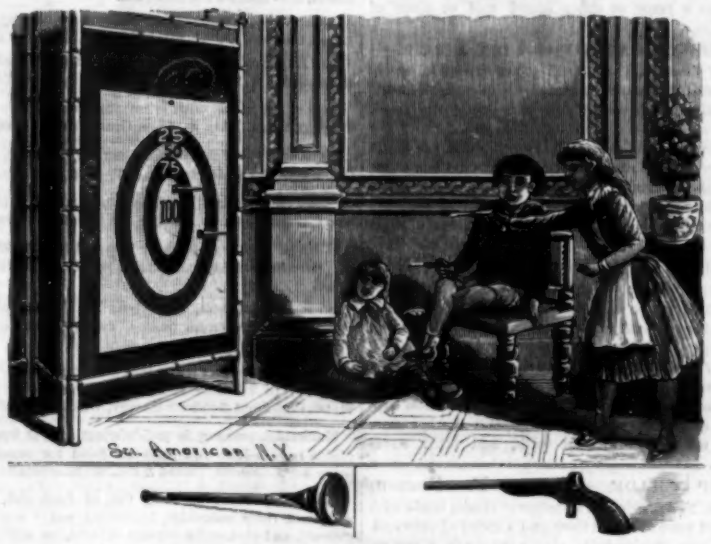


SECTION OF GATHMANN'S GUN FOR FIRING HIGH EXPLOSIVES.

A NEW TARGET PISTOL.

It is more difficult to tell why the majority of boys are naturally so fond of shooting than it is to say why parents are so averse to the practice. Certainly, shooting, especially target shooting, is a pleasant and profitable pastime, as it affords discipline for the mind and eye, exercise for the muscles, training for the nerves, gives opportunity for the display of skill, and provokes healthy and stimulating rivalry.

The record of any Fourth of July is sufficient to show that firearms, even of the cheaper sort, are not safe in the hands of children and youth. This remark might properly apply to air guns also, as they are far from being safe in careless hands.



HARMLESS PISTOL.

Inventive genius has lately produced a device which is as practical as harmless. It is not only safe as far as the operator himself is concerned, but it is incapable of harming spectators or surrounding objects. The harmless pistol consists simply of a barrel, a spiral spring placed in the barrel, a stock and a trigger. The principal novelty lies in the projectile, which consists of a rod of wood having upon one end a soft rubber cup and upon the opposite end a metallic ferrule provided with a flange, which is engaged by the trigger when the projectile is inserted in the pistol barrel. This projectile is called the "vacuum tipped arrow," on account of its ability to adhere to the target when forcibly projected by the spring of the pistol.

The target consists of a varnished sheet of cardboard, provided with the usual conventional ring and figures. The best effects are secured when the target is placed against the wall with a slight padding, such as a folded newspaper, interposed between the target and the wall. As a permanent arrangement, the addition of three or four sheets of blotting paper to the back of the target, with a retaining sheet of pasteboard, all fastened together by means of paper fasteners, has been recommended.

Reducing His Salary Saved Him.

A contemporary relates the following in support of small salaries: A Philadelphia clerk says his life was saved by having his salary reduced. He was employed as bookkeeper at $1,200 a year, but for some cause was thrown out, and afterward went to work for $750. "At that time," he says, "I was thin and weak and couldn't walk a mile to save a dollar. At any rate, I thought I couldn't. But when my income was so fearfully reduced I found it absolutely necessary to economize, and I did so by walking home from my work, a distance of about five miles. It pretty nearly killed me at first. Then I began to enjoy it. Within three months I was walking both ways, and I've kept it up ever since. Ten miles a day, summer and winter, unless during a hard storm, and look at me. One hundred and eighty pounds, the appetite of an ostrich, and not a day's sickness in ten years."

THE first canal grain receipts of the season arrived at New York May 6, in the steam canal boat William Spencer. She had 7,100 bushels of wheat, and made the passage from Buffalo in seven days and five hours.

Valuable Instructions for Engineers.

The Eclipse Pump Manufacturing Co., Cincinnati, have published the following valuable instructions to engineers. To young and inexperienced persons the directions given are of practical value and should be heeded.

1. The first duty of an engineer, when he enters his boiler room in the morning, is to ascertain how many gauges of water there are in his boilers. Never unbank or replenish the fires until this is done. Accidents have occurred, and many boilers have been entirely ruined from neglect of this precaution.

2. In case of low water, immediately cover the fire with ashes, or, if no ashes are at hand, use fresh coal. Do not turn on the feed under the circumstances, nor tamper with or open the safety valve. Let the steam outlets remain as they are.

3. In case of foaming, close the throttle and keep closed long enough to show true level of water. If that level is sufficiently high, feeding and blowing will usually suffice to correct the evil. In the case of violent foaming, caused by dirty water, or change from salt to fresh, or *vice versa*, in addition to the action above stated, check draught and cover fires with fresh coal.

4. When leaks are discovered, they should be repaired as soon as possible.

5. Blow down under a pressure not exceeding twenty pounds, at least once in two weeks—every Saturday night would be better. In case the feed becomes muddy, blow out six or eight inches every day. When surface blow cocks are used, they should be often opened for a few minutes at a time.

6. After blowing down, allow the boiler to become cool before filling again. Cold water pumped into hot boilers is very injurious from sudden contraction.

7. Care should be taken that no water comes in contact with the exterior of the boiler, either from leaky joints or other causes.

8. In tubular boilers the hand holes should be often opened, and all collections removed from over the fire. Also, when boilers are fed in front and blow off through the same pipe, the collection of mud or sediment in the rear end should be often removed.

9. Raise the safety valve cautiously and frequently, as they are liable to become fast in their seats and useless for the purpose intended.

10. Should the gauge at any time indicate the limit of pressure allowed by the inspector, see that the safety valves are blowing off. In case of difference notify the inspector.

11. Keep gauge cocks clear and in constant use. Glass gauges should not be relied on altogether.

12. Under all circumstances keep the gauges, cocks, etc., clean and in good order, and things generally in and about the engine and boiler room in a neat condition.

Blowing up a Masonry Wall.

At a recent meeting of the Institute of Marine Engineers, Mr. Joseph Thomas described the method used in removing the old dock wall at the new entrance of the Royal Albert Dock. The basin, which it was found necessary to enlarge, was surrounded on all sides by walls 38 feet deep, 20 feet wide at the bottom, and 5 feet at the top, made of concrete, composed of six parts gravel and one part Portland cement, equal to granite in hardness and strength. The ground was made up to the level of these walls and quays, and warehouses formed thereon.

Several schemes were proposed for carrying out the undertaking, which were explained by Mr. Thomas, but the plan adopted and carried out with every success consisted in using explosives fired by electricity. The effect of closing the circuit was remarkable. The entire visible length of wall was instantaneously lifted in the air in a perfect line about 6 feet, a crackling roar, a cloud of brownish smoke, and a violent surface displacement of the water in the immediate neighborhood of the wall was the only visible effect of the vast forces let loose below. So instantaneous was the effect that the chairman of the dock company, who closed the circuit, declared the wall fell to pieces before his hand struck the switch.

POISON IN CELERY.—Dr. Charles M. Cresson, of Philadelphia, states that he has more than once found the typhoid bacilli in the juice that he has squeezed out of celery grown near Philadelphia.—*Annals of Hygiene.*

RECENTLY PATENTED INVENTIONS.

Mechanical.

HAND PLANER. — Samuel M. Neely, Smith's Turn Out, S. C. This is a machine with a frame in which a carriage is adapted to travel, there being attached thereto saw or planer bits, the carriage being conveniently and expeditiously manipulated and the knives being adjustable to operate on boards of varied thickness.

DIE FOR MAKING ROCK DRILLS. — John Cahill, Tarrytown, N. Y. Combined with hinged die sections oppositely and longitudinally channeled to produce a circular aperture are four spaced guides, with die keys made to slide between them, and other novel features, whereby a steam hammer may be utilized to rapidly and perfectly form the wings and cutting edges on a rock drill.

Agricultural.

HARROW. — Niels L. Beck, Brayton, Iowa. The frame of this harrow is preferably made of iron or steel, broad at the rear and narrow in front, and having forwardly projecting teeth attached to the bars of the frame in such a manner that they will be held and firmly braced therein, while the construction is designed to be simple, durable and cheap.

PORTABLE CORN CRIB. — Charles I. Cook and Henry M. Britton, Odebolt, Iowa. The body of this crib is composed of vertical slats united by twisted wire bands, the body having a side door, and there being a detachable chain for connecting the edges of the body, the whole having a conical top and removable cover, making a cheap and strong crib to build where lumber is scarce.

RICE MACHINE. — Squire A. Pickett, Crowley, La. This machine consists of a drum or casing having its lower portion divided into compartments and its upper portion provided with partition plates with depending stop ribs, and a shaft having arms or beaters, the machine being adapted for both hulling and scouring rice.

Miscellaneous.

GATE. — William H. Clay, Paris, Ky. This invention relates to road or farm gates designed to open in either direction by a traveler on horseback or one sitting in a vehicle, the gate being operated by simply pulling on one end or the other of a rocking beam to release the gate from its latch and so that it will be tilted out of the perpendicular, swinging open by its own gravity, while it may be closed with equal facility.

INDICATOR FOR DUMB WAITERS. — Louis Friess, New York City. This is a device to be placed at the bottom of the shaft to automatically indicate the location of a dumb waiter or elevator at any point from the bottom to the top of the building, the invention covering various novel features of constructions and combinations of parts.

SPIRALLY CRIMPED HOOP. — Leonard L. Frost, Barada, Neb. This hoop is formed with a spiral groove which extends in an unbroken or in broken sections from end to end of the band from which the hoop is formed, the crimp preferably commencing above the vertical center of the band and ending below the center, the object being to prevent the displacement of the hoop in case of the shrinkage of the staves.

FIRE ESCAPE. — Adolph Boettcher, South Stillwater, Minn. Combined with a truck mounted on inclined ways, and carrying a drum, is a ladder arranged to pass over the drum, a reel to which the ladder extends, and other novel features, the apparatus being designed to facilitate escape from a burning building, while the parts are so arranged that they will be concealed when not in use.

PORTABLE CHUTE. — James Musgrave and Joseph P. Clarke, Buenos Ayres, Argentine Republic, S. A. The chute sections are combined with cables, and have transverse strips and hooked irons, the irons being arranged to engage the cables, making a readily movable and very flexible chute, which may be adjusted with facility to deliver the material with which a vessel is loaded to any one of the hatches.

PULP MACHINE. — Charles S. Bucklin, Keyport, N. J. This is a machine with curved and channeled ribs and fine and coarse sieves, to facilitate the reduction to pulp of tomatoes, pumpkins, and other vegetables, and also grapes, currants, berries, and other fruits, and separate the pulp from the seeds, skins, etc.

PORTABLE BLACKING STAND. — George W. Browne, Brooklyn, N. Y. This device has a folding casing, with a base having a back and hinged top and sides, wheels being secured to the rear face of the back, with other novel features, whereby the stand may be readily set up or closed and moved from place to place on the wheels.

RETAINING DEVICE FOR OVERSHOES. — John A. Patton, San Diego, Cal. This device consists of an S-shaped strip of spring metal, adapted to be readily applied to the top rear part of the overshoe, and afford means for convenient attachment thereto of a cord to be passed around over the instep, whereby the shoe will be prevented from being drawn from the foot by suction or otherwise.

CORNET. — John F. Stratton, Brooklyn, N. Y. This is a French or Pyrenet piston valve cornet, the mouth piece being of uniform diameter and leading to the first one of the valves, while an end pipe having a bell leads from the third of the valves, gradually increasing in size from the third valve, the improvement being designed to increase and beautify the tone.

VEHICLE SEAT TOP. — Henry McCurry, Chicago, Ill. This is a top which may be adjusted forward or backward to shield the driver from rain or sun, and in which the bows may be folded to not interfere with the loading of the vehicle, the invention covering various novel features of construction and combinations of parts.

LUMBER MEASURING DEVICE. — Thomas Newnham, Columbia, Fla. This is a machine for automatically measuring the contents of boards as they are passed through an edger or planing machine, and consists of a roll mounted to turn in a slotted box, with longitudinally extending graduations indicating board measure appearing through the slot in the box.

COMPOSITION FOR RAZOR STROPS. — Henry A. Parker, Shiloh, Tenn. This is a composition to be applied with a sponge or otherwise to cypress wood or other material of an absorbent character, the compound soaking in so that it will not need renewal, and being designed to put a very fine cutting edge upon a razor or other edged tool or piece of cutlery.

BREECH LOADING ORDNANCE. — Anthony Victorin, Troy, N. Y. This invention covers an independent removable annular breech plate, means for rotating the breech block and locking the crank handle, an improved rotatable translating roller for forcing in and withdrawing the breech block, automatic means for locking and releasing the pivoted latch that secures the swinging breech block, and an improved automatic cover or guard for the vent that prevents premature insertion of the primer, with other novel features.

PADLOCK. — William M. Brooke, New York City. This is a permutation lock so made that the shackles may be engaged and locked without adjusting the rings to form the combination, the means not being apparent to the ordinary observer, the lock consisting of flanged rings with registering notches in the flanges, and letters, figures or symbols on their periphery, the rings arranged to rotate about a vertical support, in connection with a shackle with double arms, one of which has locking teeth, and other novel features.

LAMP SHADE. — James P. Boesen, Hoboken, N. J. This is a translucent shade, made with a series of vertical single folds and a series of intersecting transverse double folds, giving the shade a conical shape, slightly curved inward in the direction of its lower edge, the shade being constructed of a single piece and designed to show upon its outer and inner faces an alternate dark and light tint.

GATE. — Philip O. Hirsch, Grand Island, Neb. This invention relates more particularly to what are known as "tilting gates," the gate being designed to be readily opened by a person approaching on horseback or in a vehicle, without dismounting, and conveniently closed after passing through.

SCIENTIFIC AMERICAN BUILDING EDITION.

MAY NUMBER.—(No. 55.)

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3. Stone residence, corner of St. Nicholas Place and 150th Street, New York city. S. Burrage Reed, architect.
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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(2172) T. H. B. asks (1) how to make an electric deposit of gold, silver, nickel, copper, etc., directly on a plaster of Paris cast. A. Coat the image with plumbago, brushed on with a hard brush; sprinkle with a little metallic iron in powder (iron reduced by hydrogen) before putting in bath, then plate by battery. 2. What is the most fusible metal at the lowest fusible point? A. Bismuth 50 parts, lead 25 parts, tin 12 parts, cadmium 13 parts. This is about the most fusible of alloys without mercury. 3. Will copper plate deposit on any metal? A. With enough battery it will on all the common metals. 4. Does the lowest fusible metal shrink in cooling? A. Yes; as it cools it contracts, though with enough bismuth it will tend to expand as it solidifies, contracting as it cools.

(2173) Mrs. W. E. asks: Can I, through the aid of your most valuable paper, find out whether cyclones, or such storms as visited our northwest during the last days of March, occur in Europe? And if not, why not? A. The regions of concentration of tornadoes and whirlwinds seem to be located in or near the meridians of greatest magnetic intensity, which may be drawn from the American magnetic pole through the Mississippi valley and Gulf of Mexico, and appearing on the opposite side of the globe from the Siberian pole through Thibet, Hindostan, and the Indian Ocean, the home of the simoons. The intermediate meridians of Europe and America, although not free from hurricanes, are less afflicted than regions on or near the meridians of magnetic intensity.

(2174) Tattoo asks: 1. What kind of ink is used in tattooing? A. India ink. 2. How can tattoo marks be removed? A. See SUPPLEMENT, No. 695.

(2175) G. W. C. asks how the noses of animals prepared for museums are kept from shriveling or puckering up while drying. A. For preventing shrinkage remove all glutinous matter by curing in a bath of 1 part salt, ¼ part alum, in a barrel of water (salinometer 30°), soak and cleanse skin of all adherent fleshy matter. In the use of this prescription experimentation and caution are necessary.

(2176) R. B. asks for something which will be likely to prove effective in removing from a rather light-colored carpet the stain of red ink? The ink does not appear to be an aniline ink. A. Possibly alcohol with some oxgall may prove of use, but success in removing it is very doubtful.

(2177) W. W. J. writes: Can you tell me how long it will take a current of electricity of 50 volts to decompose a gallon of water? Is the water heated by the process? Can you tell where I can get information to perform the experiment? A. An electric current is not measurable in volts. See SCIENTIFIC AMERICAN, February 8, 1890, page 91. The water is not sensibly heated. The rapidity depends partly on the size of electrodes and connections, partly on the electromotive force. A difference of potential of two volts is sufficient. For illustrations and descriptions of apparatus, see the SCIENTIFIC AMERICAN, May 12, 1888, page 295.

(2178) F. M. N. writes: 1. Can you give me the formula for a good and durable violin varnish? A. The true Cremona varnish is of unknown formula; its preparation is a lost art. Varnishes in general are trade secrets. The following is a formula for an oil varnish:

Amber fused	2 oz.
Oil of turpentine	5 "
Drying linseed oil	5 "

The following is for a spirit varnish:

Mastic	1 dr.
Sandarac	1 "
Lac	6½ "
Alcohol	5 fl. oz.

To tinge with yellow, annatto, aloes, gamboge, or turmeric may be used; for red, dragon's blood or red sanders wood. By mixing the above, intermediate shades may be obtained. The formula is only half the art; much depends on the application, treatment between coats, etc. It should be done by an expert. 2. Can the pinhole be substituted for the ordinary lens photographing machine by removing the lens? A. Yes; but it needs an exposure of several minutes. 3. How can I make a piece of ground glass for a camera obscura? A. Rub with a cork, water, and sand, or better, grindstone grit from the trough under a grindstone. 4. Are the photographs taken on a pinhole camera of any value? Also please give names of chemicals for either pinhole or other cameras, their proportions and how to use them. A. Treat pinhole exposed plates as you would others. Many formulæ are given in our back numbers for developers, etc. 5. Is the lens used in a camera obscura a double convex or plano-convex? A. The lens varies according to its work, whether view, portrait, wide angle, etc. 6. Would like to have instructions as to how to make a good frictional electrical machine? A. Induction machines are now universally used. See our SUPPLEMENT, Nos. 278 and 584. 7. Would like to be informed if I could make concave and convex mirrors for reflection of light or heat. A. It depends on your mechanical ability. Consult SUPPLEMENTS 139 and 318, Lens Grinding. 8. Would like to have the formula for a good liquid glue, to be used on wood and the like. A. Mix good glue with water, heat until dissolved, and add half its volume of acetic acid. 9. What kind of wire would you advise for making a spiral spring for an air gun. It requires a good spring. A. Steel is the best, next comes spring-tempered brass.

(2179) J. L. S. writes: How can I remove stains of smoke and soot from granite? Of course I could do it by chiseling over the surface, but that would not be convenient. What acid or wash would answer the purpose? A. You may have much trouble in doing this. Try the following on a portion where the stain is bad. Mix ¼ pound of soft soap, ¼ pound whiting, 1 ounce of washing soda, and a piece of sulphate of copper as big as a walnut. Rub it over the surface and let it stand 24 hours, and then wash off. This and similar compounds are recommended for marble, and may effect a cure in your case. Thus a paste of 1 ounce ox gall, 1 gill of lye (caustic soda solution, strong), 1¼ tablespoonfuls of turpentine, with enough pipe clay to make it of thick consistency, may be applied as above described.

(2180) T. H. writes: 1. Natural carbonic acid gas will settle in the bottom of a well and remain there unless forced out, being heavier than air. I have seen it stated also that it could be poured from one vessel to another, same as water, displacing the air. I filled a tin can with artificial gas, and it disappeared in 3 minutes. Is there a difference between artificial or manufactured gas and the natural? A. Both are identical, and neither will remain in an open vessel indefinitely. Artificial gas can be poured as described, but there is always a loss. 2. Fine furniture is made with wood as dry as it can possibly be made, yet in a room where natural gas is used as fuel it will still shrink. Can this be explained? A. What you see is due to deterioration of the glue rather than shrinkage of the wood. When glue becomes perfectly dry, it loses its strength. Glycerine might improve it in this regard.

(2181) J. S. F. asks: 1. Is there a patented device whereby the engine of a factory can be immediately stopped by electricity from any floor, in case of accident? A. Yes. 2. Would not the inhalation of pure oxygen mixed with air, or with nitrous oxide, be of probable benefit in chronic disorders of the nervous system, where a general condition of debility is the main trouble? A. Oxygen inhalation is now a part of regular medical practice. Nitrous oxide has anæsthetic properties that necessitate care in its application. It is used principally as an anæsthetic, but can be applied as a remedy.

(2182) W. E. A. asks: 1. What fraction of a horse power would be required to properly run a propeller six inches in diameter? A. One-eighth horse power. 2. What size should an aggregate of say eight electro-magnets be to attract with a force equal to one-fifth horse power, *i. e.*, what length and diameter the cores and number and length of wire? A. Magnets do not attract with horse power; the weight sustained varies with the current. 3. Can an ordinary bolt be softened sufficiently to be used in the construction of electro-magnets? If so, by what process? A. Yes. Heat to white heat and bury over night in forge cinders to a good depth. 4. How many hours will a chloride of silver battery last on a closed circuit, having about

eight dwt. of chloride of silver? A. Not long; it depends on resistance of circuit. 5. About what part of a horse power is 25 volts and 4 amperes equal to? A. Nearly one-seventh.

(2183) Sydney asks: 1. If sirup for cordial be made with cold water, is it more likely to ferment than if it were boiled? A. Yes. 2. The best way to prepare charcoal for refining spirit, and whether any particular wood should be used. If the charcoal were merely placed in a cask of spirit, would it absorb the injurious matter and have the same effect as if it were filtered? A. Animal charcoal is most efficient. 3. The best mode for filtration of small quantities of spirits of about 30 gallons at a time. A. Use a percolator, and pack in the charcoal solidly. 4. The best publication on mode of preparation of American drinks, and price, including postage to Sydney? A. Jerry Thomas' "How to Mix Drinks, or the Bartender's Guide," 75 cents. 5. Has the aerating of wines been tried in America, and with what success, also the price of such aerating machine? A. Not to any extent with fine wines. Cider can be thus treated. 6. Best mode of preparation of raisin wine. A. We refer you to the SCIENTIFIC AMERICAN, December 8, 1888, page 356, for an article on the subject by U. S. Consul E. Johnson, Kehl, Germany.

(2184) H. C. K. asks: 1. What is the theory of the Tesla motor, and what is gained by the two independent circuits as shown in your SUPPLEMENT, No. 602? A. The two independent coils are connected in series. The whole is so proportioned that there is a constant difference of one-quarter phase between the two, owing to hysteresis or "magnetic lag." This causes the axis of north and south polarity to constantly vary, rotating always in the same direction. The armature induced itself keeps trying to "keep up," and hence rotates. 2. In SUPPLEMENT, No. 718 or 734, what is meant by the Carpentier bobbin (type 600 francs)? Is it an addition to, or is it the Ruhmkorff coil that is meant in the article "On M. H. Hertz' Experiments." A. The Ruhmkorff coil is indicated.

(2185) E. A. C. writes: I have noticed that many brass castings when taken from the sand are perfectly clean and of a uniform, almost golden color. How is this obtained? A. The golden-colored castings are made from clean metal, without iron: Copper 16 ounces, tin 1 ounce, zinc 1 ounce. The flasks should be opened quickly, in from 5 to 15 minutes after pouring, according to size of pieces, and the gate of work raised, sand rapped off, and plunged in water to check oxidation. A little practice will give proper manipulation. Should only have a quick dip, so that the heat of the castings will dry them. 2. Is there any constant battery of higher E. M. F. than the gravity battery? If so, what and how prepared? A. No practical battery. 3. Why will not the gravity battery run an induction coil? A. It can be so used.

(2186) V. R. asks: What causes the report and the recoil of a gun when a charge is fired? Are the recoil and report caused by air rushing into the barrel after the bullet has left the muzzle? Is there a vacuum formed in the barrel while the bullet is leaving it? Has the vacuum (if formed) anything to do with the report and recoil? A. The report is the vibration of the air, due to the instantaneous explosion. The recoil is the result of the sudden pressure generated within the gun pushing the gun in the opposite direction from that of the ball. There is no vacuum formed, but a large volume of gas is generated by the combustion of the powder, producing a great pressure upon gun and ball, sending them in opposite directions.

(2187) C. C. asks: Will a piece of timber ready to use in a mechanical way, ordinary dry timber, shrink endways? For instance: A piece of oak timber 6 inches by 6 inches square, 5 feet long, would the decrease in length be perceptible, and is it not an ordinary expression that timber does not shrink endways? A. Timber in drying has a very small shrinkage endwise. After it is seasoned, the permanent shrinkage becomes imperceptible, but changes in temperature, and the dry and wet seasons, may make slight variation in length. In architecture endwise shrinkage is not taken into account.

(2188) J. S. S. writes: In performing the experiment of putting an iron bar in the plane of dip and striking it a few blows with a hammer, I noticed this phenomenon, viz., both ends of the bar repelled the north and attracted the south poles of a compass. Why is this? Where were the consequent points? Must there not have been one of them missing in the chain? A. You have at least two consequent south poles in the middle portions of your bar. If you saw it in two, you may succeed in finding them.

(2189) W. B. J. asks: If the governing arrangement of an engine could be made so perfect that the least perceptible change in speed would regulate the supply of steam instantly from 0 to its full capacity, or just enough to insure an even and steady speed, could the flywheel of the engine be dispensed with? Is there a governor in use that regulates the engine in such a way that the same speed is maintained when working under a heavy or light load, provided there is steam enough to overcome the load? A. The automatic system of governing engines, as now in use, is probably as nearly perfect as the mechanical difficulties will allow. We see many difficulties in dispensing with the flywheel on a reciprocating engine, from the peculiar conditions of the application of pressure upon the piston. Uniform tangential pressure on the crank pin through its entire circle is one condition for dispensing with a flywheel.

(2190) B. H. S. asks: Can you give me a good receipt for waterproofing canvas, such as is used for canvas canoes? An elastic coating is preferable, so that the canvas may be folded. A. The best advice we can give is to have your canvas coated with India-rubber. You may waterproof it by treating with a solution of 1 part gutta percha in 10 parts turpentine mixed with 10 parts linseed oil, or with 125 parts soluble gun cotton dissolved in 425 parts ether, mixed with 375 parts castor oil and 25 parts umber or the pigment. When the canvas is not to be disturbed, painting or varnishing is the best treatment. For all cases the canvas should be perfectly dry.

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April 29, 1890.

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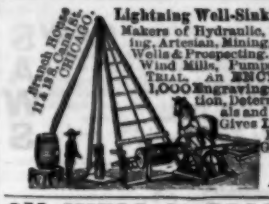

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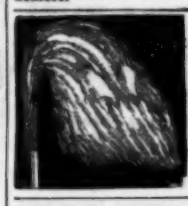

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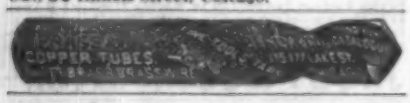

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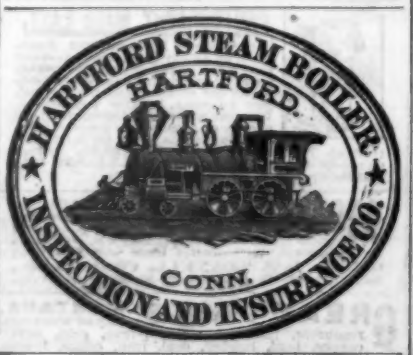

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